
Surface Transportation System Funding Alternatives Phase II Evaluation Mileage-Based User Fee Pilot by the Eastern Transportation Coalition

FHWA-HOP-21-049

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SI* (MODERN METRIC) CONVERSION FACTORS				
APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in ²	square inches	645.2	square millimeters	mm ²
ft ²	square feet	0.093	square meters	m ²
yd ²	square yard	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft ³	cubic feet	0.028	cubic meters	m ³
yd ³	cubic yards	0.765	cubic meters	m ³
NOTE: volumes greater than 1000 L shall be shown in m ³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in ²	poundforce per square inch	6.89	kilopascals	kPa
APPROXIMATE CONVERSIONS FROM SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm ²	square millimeters	0.0016	square inches	in ²
m ²	square meters	10.764	square feet	ft ²
m ²	square meters	1.195	square yards	yd ²
ha	hectares	2.47	acres	ac
km ²	square kilometers	0.386	square miles	mi ²
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m ³	cubic meters	35.314	cubic feet	ft ³
m ³	cubic meters	1.307	cubic yards	yd ³
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
TEMPERATURE (exact degrees)				
°C	Celsius	1.8C+32	Fahrenheit	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in ²

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

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LIST OF ABBREVIATIONS

app	application
BEV	highly fuel efficient vehicle
DelDOT	Delaware Department of Transportation
ELD	electronic logging device
ETC	Eastern Transportation Coalition
FAST	Fixing America's Surface Transportation
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carriers Safety Administration
FY	fiscal year
GPS	global positioning system
HOS	hour of service
ICE	internal combustion engine
IFTA	International Fuel Tax Agreement
IRP	International Registration Plan
MBUF	mileage-based user fee
MPG	mile per gallon
MRD	mileage reporting device
MRM	mileage reporting method
NIST	National Institute of Standards and Technology
OBD-II	onboard diagnostics
PennDOT	Pennsylvania Department of Transportation
RFID	radio-frequency identification
RODS	record of duty status
RUC	road usage charge
STSFA	Surface Transportation System Funding Alternatives
USDOT	U.S. Department of Transportation

EXECUTIVE SUMMARY

This report presents Phase 2 evaluation results of the Eastern Transportation Coalition's (TETC, formerly the I-95 Corridor Coalition) mileage-based user fee (MBUF) pilot. TETC received funding in fiscal years (FY) 2016–18 under the U.S. Department of Transportation's (USDOT) Surface Transportation System Funding Alternatives (STSFA) program. This report provides findings from Phase 2 of TETC's examination of the feasibility of MBUF, toward which the Delaware Department of Transportation (DelDOT) (on behalf of TETC) received \$975,000 in Federal funds in FY 2017 (Phase 2).¹ TETC applied this funding to passenger pilots conducted from July 2019 through October 2019 and a motor carrier pilot conducted October 2018–March 2019. Consequently, TETC refers to these programs as the 2019 Passenger Vehicle Pilot and 2018/2019 Truck Pilot in their documentation. However, for the purpose of this report, all activities funded by the second phase of the STSFA grant are referred to as Phase 2 activities. TETC was one of 11 entities to engage in programs to demonstrate or implement user-based alternative transportation revenue mechanisms at the time of the award of the Phase 2 grant.

BACKGROUND

As vehicles become more fuel efficient, the reliability and adequacy of the motor fuel tax as a primary source for transportation infrastructure funding continues to decline. Section 6020 of the Fixing America's Surface Transportation (FAST) Act² established the STSFA program to provide grants to States to demonstrate user-based alternative transportation revenue mechanisms that employ a user-fee structure to maintain the long-term solvency of the Highway Trust Fund. The objectives of the STSFA program are to:

- Test the design, acceptance, and implementation of two or more future user-based alternative revenue mechanisms
- Improve the functionality of the user-based alternative revenue mechanisms
- Conduct outreach to increase public awareness about the need for alternative funding sources for surface transportation programs, and to provide information on possible approaches
- Provide recommendations regarding adoption and implementation of user-based alternative revenue mechanisms
- Minimize the administrative cost of any potential user-based alternative revenue mechanisms

The Federal Highway Administration (FHWA) Office of Operations has overall responsibility for administering the STSFA program. FHWA division staff provide support by overseeing the program in participating States.

The U.S. Congress and FHWA seek to understand whether user-based alternative transportation revenue mechanisms that employ a user-fee structure can help maintain the long-term solvency of the Highway Trust Fund, and whether they can be implemented nationally in the future.

¹ While DelDOT was the grant applicant and receiver of funds as per the requirements of the STSFA program, the pilot was executed and managed by TETC.

² Pub. L. No. 114–94.

FHWA supported independent evaluation of several grantee sites at key program milestones. The reports from the independent evaluations will enable the Secretary of Transportation and Congress to be aware of progress made, lessons learned from pilot and planning efforts, the role of education and outreach, the potential for any negative impacts on constituents, and initial findings on administrative fees.

THE EASTERN TRANSPORTATION COALITION MILEAGE-BASED USER FEE PILOTS

Phase I of TETC's program (funded by the FY 2016 STSFA grant) included planning and pre-deployment activities as well as a limited passenger pilot with 155 participants. The findings from this phase are documented in a separate report, entitled *Exploring a Mileage-Based User Fee in a Multi-State Region - Delaware Department of Transportation on behalf of the Eastern Transportation Coalition*.

Phase 2 of TETC's program (funded by the FY 2017 STSFA grant) is comprised of two parts which will be discussed separately:

- **Expanded passenger vehicle pilot.** This effort expanded upon the Phase 1 pilot that included participation from 155 transportation stakeholders and focused on the States of Delaware and Pennsylvania. The Phase 2 expanded passenger vehicle pilot was conducted from July through October 2019. The pilot included 899 participants from the general public in Delaware and Pennsylvania and was executed by TETC in partnership with DelDOT and the Pennsylvania Department of Transportation (PennDOT). A key purpose of this pilot was to bring the insights and concerns of the general public about a sustainable and equitable transportation funding approach into the national discussion.
- **Multi-State truck pilot.** Recognizing that the motor carrier industry has a key role in the U.S. economy and is a heavy user and funder of the transportation system, TETC conducted a multi-State truck pilot to include the perspective of the trucking industry into the national exploration of MBUF. This effort constitutes the first multi-State truck pilot funded by the STSFA program.

MAJOR FINDINGS

The evaluation systematically assessed the impacts of STSFA-funded activities across all sites. The following are key findings of TETC's Phase 2 passenger vehicle pilot based on the FAST Act³ evaluation criteria:

- **Technical accuracy, precision, and repeatability of mileage reporting methods (MRMs).** Providing a broad range of technology options to report mileage allows drivers to make trade-offs according to their needs, preferences, abilities, and sensitivities. The following are key findings regarding mileage reporting devices (MRDs) used in the Phase 2 pilot:
 - The global positioning system (GPS)-enabled onboard diagnostics (OBD-II) device was accurate enough to identify vehicles within a tolling express lane with 90-percent accuracy, compared to the radio-frequency identification (RFID) transponder. This

³ Pub. L. No. 114-94.

suggests the technology could potentially support interoperability between MBUF and tolling.

- The non-GPS OBD-II device will maintain the same level of accuracy as the vehicle's odometer, which is subject to a number of variables that can affect accuracy.
- **Public outreach and communication.** Given limited public knowledge about transportation funding topics, TETC used a multipronged approach including broad-based media strategies, social media campaigns, and specific stakeholder outreach by State agencies for pilot enrollment. Future pilots may benefit from public opinion surveying that oversamples respondents from populations of interest (e.g., by income or race) so the views of these groups can be assessed with some certainty. Similarly, future pilots may also benefit from a pilot participant recruitment plan designed to ensure inclusion of a diversity of participants across race, income, English language proficiency and other demographic dimensions.
- **Public perception and acceptance of road usage charge (RUC).** The pilot led to a marginal increase in participant support for adopting MBUF as the primary transportation funding source. The pilot did not significantly change participants' attitudes toward fairness of MBUF overall. However, it decreased participants' uncertainty and slightly increased confidence that MBUF is fairer than fuel taxes. The surveys and focus groups confirmed that fairness and the concept of "pay for what you use" is the strongest argument in favor of an MBUF. The pilot helped increase participants' appreciation for certain aspects of an MBUF, such as a relatively lower tax burden for low fuel-efficient vehicles. The pilot successfully provided TETC with insights into participants' preferences, such as an MRD with location data collection capability, despite their privacy concerns. It also provided insight into other participant concerns such as fairness for all users and for specific categories of users (e.g., rural drivers, low-income drivers, drivers of electric and hybrid vehicles.)
- **Interoperability and reconciliation.** TETC recognizes the need for interoperability of a future MBUF system. The eastern seaboard includes several large urban centers, often spread across many State boundaries. For a fair application of an MBUF, interstate travel would need to be accounted for. Understanding how out-of-State mileage may be estimated and applied to calculate a rate is a key requirement for offering MRDs that do not collect location information from drivers. TETC's Phase 1 analysis indicated that estimates of out-of-State travel did not accurately represent actual miles driven by participants by State. For Phase 2, TETC devised a rate calculation mechanism to consider interstate travel based on census data about travel in the region. However, more analysis may be needed to understand and account for interstate travel for drivers who choose non-GPS-enabled MRDs. TETC also evaluated the potential to integrate MBUF technology into tolling for a streamlined, consolidated approach to reporting and administering fees for both systems. Pilot results suggest MBUF technology could potentially be used in tolling applications but may require additional study and piloting.
- **Privacy and data security.** The topic of data security was not the primary motivation among pilot participants. However, results from pilot participants helped alleviate some concerns about privacy and data security among participants.

- **Ease of user compliance and transparency.** The highly automated MRDs and the ability for participants to access accounts and trip logs were both useful in supporting compliance and transparency. The complications of frequent interstate travel on the eastern seaboard make tracking, user auditing, and transparency complex. For users of GPS-enabled OBD-II devices, interstate travel data were available to calculate the cost of travel across multiple States with different per-mile fees. However, the process to audit the calculations would be complex for users who frequently cross State lines. Account statements and trip logs were made available to participants to show the fees were determined based on mileage driven within each State. For non-GPS OBD-II device users, only an estimate of out-of-State miles driven was used to calculate the fee. All travel was charged under a flat, blended rate regardless of where actual travel occurred. As such there was less effort involved in auditing the data for this MRM.
- **Equity.** The STSFA program does not specify a definition of the term equity, thus allowing grantees to make the determination of equity dimensions of interest. In both phases, TETC explored equity with respect to two dimensions: people living in urban versus rural areas and people driving vehicles with different fuel efficiencies (or EVs). Analyses looking specifically at the opinions and understanding held by members of populations based on income, race, ethnicity, gender, or English language proficiency were not conducted because it was not within the scope of TETC's Phase 2 exploration. The pilot participants' perception of MBUF's equity slightly increased during the pilot. However, focus groups uncovered a need for wider public education about a user-fee approach and its potential impact on the majority of residents—relative to their current tax burden and in relation to other interest groups. A qualitative analysis of equity considerations presented multiple inter-related impacts that may need to be addressed if a variable rate structure or directed payment assistance program were to be investigated as part of the MBUF program.

The scope of TETC's Phase 2 pilot did not include significant exploration of system cost, congestion mitigation, the system's ability to audit, or data security and privacy considerations.

The following are key findings of the evaluation, of TETC's Phase 2 truck pilot:

- **System Design and Technical Accuracy.** The systems developed to satisfy some of the existing trucking industry regulations are suitable for an MBUF since they are already used for financial transactions based on location accuracy. However, not all electronic logging devices currently in use in the trucking industry have the location accuracy to support financial transactions and fee collection.
- **Ease of compliance and transparency.** TETC concluded that the use of a highly automated in-vehicle device that currently satisfies some of the existing regulatory requirements for trucking, streamline the collection and reporting requirements that trucks and fleets are required to follow. Using an interactive screen would allow the system to communicate information to the driver to facilitate an understanding of how fees are assessed and how mileage is accrued through different States.
- **Rate structure and funds reconciliation.** TETC found that some trucking industry regulations provide a framework for developing an MBUF applied to commercial trucks that has the potential to work across State lines. However, the pilot concluded that more study is needed to understand how funds are reconciled, how rates are set, and how the

system would extend beyond vehicles that have to adhere to those requirements. Additional effort is also needed to better understand the impacts of transitioning from a diesel motor fuel tax toward an MBUF that considers the complex facets that apply to the trucking industry. TETC concluded that a flat rate applied to all trucks will have different impacts based on several factors. The trucking industry encompasses several business models such as over-the-road trucking, long-distance haulers, drayage trucks that have different load characteristics, per-mile costs, time sensitivities, and ownership models. Each of these business models may be affected in different ways by a shift from the diesel motor fuel tax toward an MBUF. An effort to make an MBUF revenue neutral will require a policy framework that recognizes these potential impacts.

- **Stakeholder engagement and feedback.** A key finding from the truck pilot was the importance of engaging the trucking industry and fully understanding their perspective related to an MBUF. The trucking industry is complex, highly regulated, and will experience an MBUF in a different way than passenger vehicles would. Making sure their voice is understood and the unique challenges of the industry are incorporated in the design of a commercial vehicle MBUF is an important component of future MBUF exploration.

CHAPTER 1. INTRODUCTION

As vehicles are becoming more fuel efficient, the reliability and adequacy of the gasoline tax as a primary source for transportation infrastructure funding have come into question. Section 6020 of the Fixing America's Surface Transportation (FAST) Act⁴ of 2015 established the Surface Transportation System Funding Alternatives (STSFA) program. The purpose of this program is to provide grants to States to demonstrate user-based alternative transportation revenue mechanisms that employ a user-fee structure to maintain the long-term solvency of the Highway Trust Fund.

“Motor fuel tax receipts are projected to decline as vehicles become more fuel-efficient and the surge of new electric vehicles continues to spark interest among buyers. Given these two major pressures on the motor fuel tax, [S]tates have begun to actively study, explore and pilot road user charge (RUC) systems as the most likely long-term replacement for declining MFT revenue.”

Source: National Conference of State Legislatures, “Road Use Charges (RUC)” web page, accessed June 12, 2023, [State Road Usage Charge Series \(ncsl.org\)](https://www.ncsl.org/transportation/road-use-charges.aspx)

By funding road usage charge (RUC) pilots, the U.S. Congress and the Federal Highway Administration (FHWA) seek to understand whether a user-fee structure, such as RUC, could be implemented nationally in the future. FHWA supported the independent evaluation of several grantee sites at key program milestones. The evaluation reports will inform the Secretary of Transportation and Congress of the progress made, lessons learned from pilot and planning efforts, role of education and outreach, potential for negative impacts on constituents, and initial findings on administrative fees.

In fiscal year (FY) 2016, the U.S. Department of Transportation (USDOT) awarded eight STSFA grants to seven States totaling \$14.2 million. This constituted Phase 1 of the STSFA program. Seven site reports and one cross-cutting findings report were developed corresponding to the grantee activities for this phase. In subsequent phases, FY 2017-2019, \$15.5 million, \$10.3 million, and \$15.1 million were respectively awarded under the program. Figure 1 shows the grantee States that received funding under the STSFA program, from inception through FY 19 for State or interstate or regional pilot efforts.

FHWA Office of Operations has the responsibility for administering the STSFA program. FHWA division staff provide support by overseeing the program in participating States. FHWA led an independent evaluation of the program, applied systematically across all sites, to assess the impacts of the STSFA-funded activities that had been conducted by each grantee. The objective of the evaluation was to document applicability of, motivation for, and impediments to implementing user-based fee mechanisms as alternatives to the gas tax on a nationwide level in the future. This report documents the findings of the independent evaluation of the Eastern Transportation Coalition's (ETC) pilot activities supported by 2017 STSFA grant funds.

The evaluation team adopted the terminology used by the grantee sites in planning and executing their proposed programs. Identical or similar concepts in different geographies may variably be referred to as mileage-based user fee (MBUF), distance-based user fee, or RUC. Given the lack

⁴ Pub. L. No. 114-94.

States Involved in STSFA Funded Initiatives

- Pilot Sites / Grantees
- ▨ Participants in Interstate Pilots

Figure 1. Illustration. States involved in initiatives funded by the Surface Transportation System Funding Alternatives program through fiscal year 2019.

This report presents STSFA Phase 2 pilot activities undertaken by TETC. Toward this phase of TETC’s pilot, the Delaware Department of Transportation (DelDOT) (on behalf of TETC) received \$975,000 in Federal funds under the STSFA program.⁵ TETC applied this funding to passenger pilots conducted from July 2019 through October 2019 and a motor carrier pilot conducted October 2018–March 2019. Consequently, TETC refers to these programs as the 2019 Passenger Vehicle Pilot and 2018/2019 Truck Pilot in their documentation. However, for the purpose of this report, all activities funded by the second phase of the STSFA grant are referred to as Phase 2 activities.

The second phase of TETC's program was comprised of two parts:

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- **Expanded passenger vehicle pilot.** The expanded passenger vehicle pilot was conducted from July through October 2019. The pilot included 899 participants from the general public in 14 coalition States (identified in figure 1 above). TETC partnered with DelDOT and the Pennsylvania Department of Transportation (PennDOT) for pilot execution. The two State DOTs conducted targeted recruitment of participants from the 12 other coalition States. This effort was a follow-up to the 2018 pilot that had included participation from 155 transportation stakeholders and was focused on the States of Delaware and Pennsylvania.
- **Multi-State truck pilot.** Recognizing the motor carrier industry has a key role in the U.S. economy and is a heavy user and funder of the transportation system, TETC conducted a multi-State truck pilot to include the perspective of the trucking industry into the national exploration of MBUF. The truck pilot lasted 6 months, from October 1, 2018, to March 31, 2019. Approximately 50 trucks participated and traveled more than 1,430,000 miles across 27 States. The pilot involved an automated approach to mileage data collection. The pilot was intended to establish a starting point to further engage the motor carrier industry in a constructive conversation about MBUF.

This effort constituted the first multi-State truck pilot funded by the STSFA program.

ORGANIZATION OF THIS REPORT

Chapter 1 introduces the user-fee concept and the background and purpose of the pilot.

Chapter 2 details the activities planned and accomplished by TETC under Phase 2 of the STSFA grant program or the FY 17 grant cycle.

Chapter 3 presents the evaluation framework developed for this effort, including USDOT questions the evaluation seeks to address and the evaluation team's approach.

Chapter 4 provides the major findings from evaluation of Phase 2 passenger car pilot, including lessons learned, findings, outcomes as observed by the evaluation team, and suggestions for further exploration in future efforts toward an alternative revenue program.

Chapter 5 provides the major findings from evaluation of Phase 2 truck pilot, including lessons learned, findings, outcomes as observed by the evaluation team, and suggestions for further exploration in future efforts toward an alternative revenue program.

Chapter 6 summarizes the key takeaways from Phase 2 activities and lessons learned that would be relevant for a national implementation of an MBUF program.

CHAPTER 2. THE EASTERN TRANSPORTATION COALITION'S MILEAGE-BASED USER FEE PILOT PHASE 2

OVERVIEW OF THE MILEAGE-BASED USER FEE PILOT

This section provides an overview of the passenger vehicle pilot and the truck pilot conducted as part of Phase 2 of TETC's MBUF program. Both pilots were aimed at promoting a better understanding of why investing in transportation is important and why the current fuel tax does not provide a long-term and equitable solution to the problem. TETC took a neutral approach to investigating MBUF (i.e., it engaged partners and stakeholders in the pilot initiatives but refrained from advocating a user-fee approach as the ultimate solution). The truck pilot was also aimed at gaining a better understanding of motor carriers' needs and viewpoints, and for exploring the feasibility of existing regulations and technology as a framework for an MBUF approach.

Both pilots involved generating and distributing simulated statements to the participants. The statements presented, among other statistics, a comparison of estimated Federal and State fuel tax assessments and an equivalent MBUF. The pilots had strong stakeholder engagement components that were executed through the use of surveys, focus groups, electronic communication methods, and direct engagement with interest groups.

Passenger Vehicle Pilot

TETC's 2019 passenger vehicle pilot, conducted from July through October 2019, included 889 participants from the general public in 14 coalition States. More than 80-percent of participants were from the general public in Delaware and Pennsylvania. DelDOT and PennDOT conducted targeted recruitment of participants from the twelve other coalition States. The goal of the pilot, according to TETC, was "to bring the insights and concerns of the general public into the national discussion about a sustainable and equitable transportation funding approach."⁶

Mileage Reporting Options

Pilot participants had the option of choosing between two automated mileage reporting methods (MRMs):

- **Plug-in device with location:** This method involved a device that plugs into the vehicle's onboard diagnostic (OBD-II) port. Vehicle location and distance traveled data collected with this device were used to calculate the MBUF. A location-based MBUF enabled accurate assessment of fee based on State-specific MBUF rates and miles driven in the respective State. The location-based device also provided a broader array of value-added features for the vehicle owner.
- **Plug-in device without location:** This device plugs into the vehicle's OBD-II port that uses vehicle data to calculate the MBUF based on a pre-defined estimate of the State(s) where miles are driven.

⁶ TETC, *Mileage-Based User Fee Exploration: 2019 Passenger Vehicle Pilot* (2021).

TETC explored additional mileage reporting options, including use of in-vehicle telematics and plug-in devices for the 12-volt power outlet for cars that did not have an OBD-II port. These mileage reporting options were not incorporated into the pilot due to technology limitations, cost, or reporting accuracy concerns.

Mileage-Based User Fee Calculations

TETC adopted a net revenue neutral approach to determine per-mile rates and fuel tax credits for the Phase 2 pilot. The formula assumed a national fuel economy average of 22 miles per gallon (MPG). This assumption was used to calculate each State's per-mile MBUF rate such that proceeds from an MBUF program were equal to the amount collected towards the State fuel taxes. A 19-percent fee was added to cover the estimated costs associated with MBUF system administration and compliance. This was based on the results of financial analyses prepared for Delaware and Pennsylvania during the Phase 1 MBUF work.⁷

The per-mile rate calculation is $\text{per-mile rate} = (\text{State fuel tax} \div \text{national fuel economy average of 22 MPG}) * 1.19$.

Since each State in TETC was presumed to have a unique per-mile MBUF rate, interstate miles driven were treated differently for each mileage reporting option:

- Plug-in device with location: Miles driven data were differentiated by the State where the mileage was driven for participants choosing this method. The net mileage fee was based on each State's per-mile rate, minus a credit for the State fuel tax for the estimated gas consumed in each State. Table 1 shows the per-mile rates and State fuel tax amounts for each Coalition State.
- Plug-in device without location: For each vehicle, a percentage of the mileage and fuel tax payments was assumed to have occurred in the vehicle's home State. The MBUF was calculated by applying the participant's State of residence per-mile rate and fuel tax to this estimated in-State mileage. The remaining percentage of the vehicle's mileage was assumed to have been driven in States adjacent to the participant's home State. For the mileage estimated to have been driven in adjacent States, the average per-mile fee and average fuel tax for out-of-State mileage were based on the per-mile rates and State fuel taxes in adjacent States.

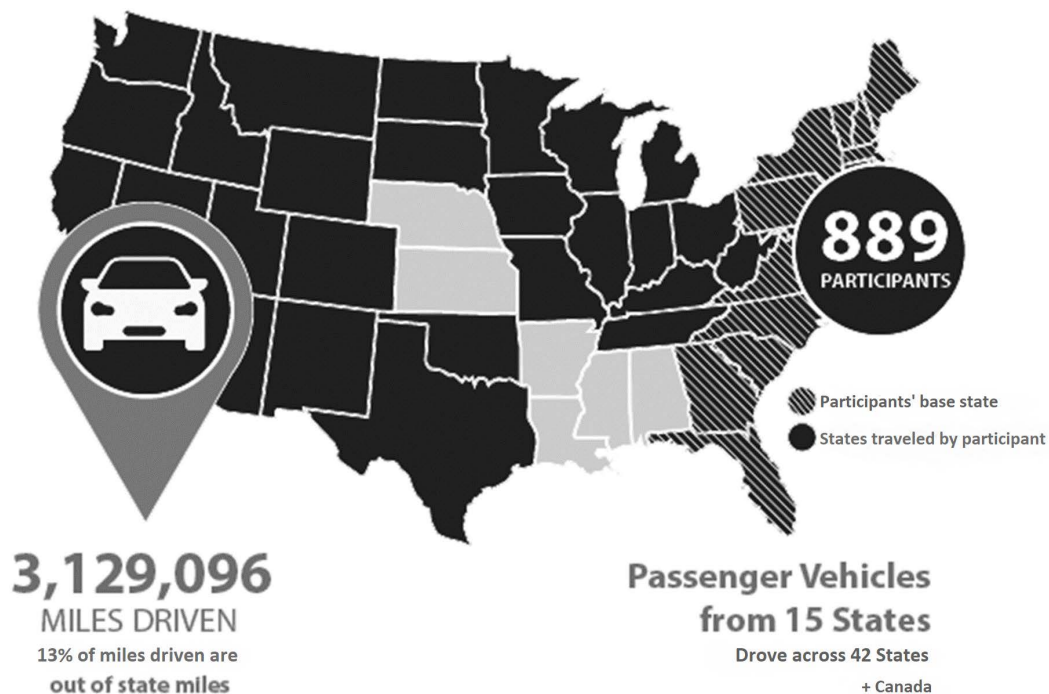
Pilot Operations

TETC's selected vendor provided mileage reporting technology and account management for enrolled participants. In addition to the two MRMs, the vendor also provided value-added amenities to participants. These amenities included different types of vehicle and travel information such as: trip logs, vehicle health, battery voltage, driver scoring, safe zones and guidance to find vehicle using smartphone. The vendor was also responsible for issuing mock invoices that provided participants details on their MBUF charges including miles traveled and fuel tax by State.

⁷ I-95 Corridor Coalition, *Mileage-Based User Fee Study* (2019), https://tetcoalitionmbuf.org/wp-content/uploads/2020/07/Coalition-MBUF-Admin--Compliance-Issues-Tech-Memo_2019.pdf.

Pilot Statistics

As shown in figure 2, nearly 900 vehicles from 14 Coalition States and Washington, DC, participated in the Phase 2 passenger vehicle pilot, accumulating almost 3.13 million miles across 42 States and Canada. Eighty percent of pilot participants selected the plug-in device with location.



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Figure 2. Illustration. States where mileage was accrued during Phase 2 passenger vehicle pilot.

Table 1 summarizes the average monthly mileage and MBUF per vehicle during the 4-month pilot. The average number of miles driven by pilot participants each month was just over 1,200 miles. The average monthly MBUF paid per vehicle was \$27.67, which is nearly \$7.50 more per vehicle, on average, than the estimated fuel tax paid per vehicle. According to TETC, the increased MBUF amount relative to the gas tax is the result of two factors:

- When using a single MBUF rate framework based on the national average of 22 MPG, drivers of vehicles with fuel efficiency greater than 22 MPG will pay more in MBUF than they pay in fuel taxes. Drivers of vehicles with fuel efficiency less than 22 MPG will receive a credit because the MBUF is less than the amount they pay in fuel tax. The average fuel efficiency of vehicles participating in the pilot was 25.3 MPG, resulting in MBUF payments being higher than the gas tax credit.
- The 19-percent administration fee included in the 2019 MBUF rates cover the additional estimated administration and compliance efforts associated with MBUF.⁸

⁸ DHM Research, *I-95 MBUF: Focus Group and Participant Surveys-Summary* (2019).

TETC contends that one-third of the increased average monthly payment of \$7.49 can be attributed to the higher average MPG of participant vehicles. The remainder can be attributed to additional administrative and compliance costs.

Table 1. Average monthly mileage and mileage-based user fee (MBUF) per vehicle.

Month	Average No. Vehicles	Monthly Averages per Vehicle			
		Chargeable Miles	MBUF	Gas Tax Credits	Net Revenue
July 2019	201	1,103	\$28.34	-\$20.33	\$8.02
August 2019	587	1,261	\$30.32	-\$22.49	\$8.14
September 2019	846	1,223	\$27.33	-\$19.84	\$7.38
October 2019	886	1,228	\$27.15	-\$19.80	\$7.35
Pilot Average	630	1,203	\$27.67	-\$20.25	\$7.49

Source: Eastern Transportation Coalition.

Truck Pilot

The multi-State truck pilot lasted from October 1, 2018, to March 31, 2019, and included participation from more than 50 trucks. The pilot explored how the MBUF concept could be applied to heavy trucks, as well as feasibility of using existing regulations, administrative processes, and technology as a potential MBUF framework.

Mileage Reporting Options

The pilot was supported by a private sector technology and commercial service provider for the trucking industry. The service provider's business model is a secure onboard unit that collects data to provide regulatory and commercial services (e.g., International Fuel Tax Agreement (IFTA) reporting,⁹ weight-mileage tax reporting), and provides trucking companies with tools to monitor driving performance and improve fleet management. The onboard unit uses a combination of external and internal sensors to measure the distance the vehicle travels and location and route information. The vehicle data captured from the hardware are transmitted by a secure cellular link to a web-based platform where they are processed to calculate and prepare records and reports, such as IFTA, and MBUF charges. The pilot thus used existing technology and a business model to collect the data needed to measure and collect an MBUF.

Mileage-Based User Fee Calculations

TETC developed per-mile MBUF rates for each Coalition State using the average fuel efficiency for trucks and each State's diesel tax rate. These per-mile rates were developed to be revenue

⁹ IFTA is an agreement between the lower 48 States in the United States and 10 Canadian provinces to simplify reporting of fuel taxes by interstate motor carriers. IFTA was set up as a nationwide approach for reporting information and fairly distributing State fuel taxes among States, thereby replacing the non-uniform, expensive, and burdensome requirements of State-level systems.

neutral (i.e., a truck getting the national average MPG would pay the same amount of MBUF as paid in State diesel tax).

Table 1 shows the per-mile rates for each Coalition State and the diesel fuel tax rates (provided as a credit against the MBUF). The truck's onboard system measured the number of miles driven in each State by road type and by each equipped truck. This mileage information was used to calculate the MBUF for each Coalition State in which the truck was driven using the per-mile rates shown in table 2.

Table 2. Per-mile rates used in the multi-State truck pilot (based on an average mileage of 6 miles per gallon).

State	Per-mile rate (cents per mile)	Diesel excise tax (cents per gallon)
Connecticut	7.32	43.09
Delaware	3.67	22.00
District of Columbia	4.00	23.50
Florida	5.73	34.97
Georgia	5.00	40.07
Maine	5.20	31.20
Maryland	5.76	36.05
Massachusetts	4.00	26.54
New Hampshire	3.70	23.83
New Jersey	7.37	48.50
New York	6.53	44.61
North Carolina	5.85	36.45
Pennsylvania	12.35	75.20
Rhode Island	5.50	34.00
South Carolina	3.33	20.75
Vermont	5.17	32.00
Virginia	3.37	24.71

Source: Eastern Transportation Coalition.

Pilot Operations

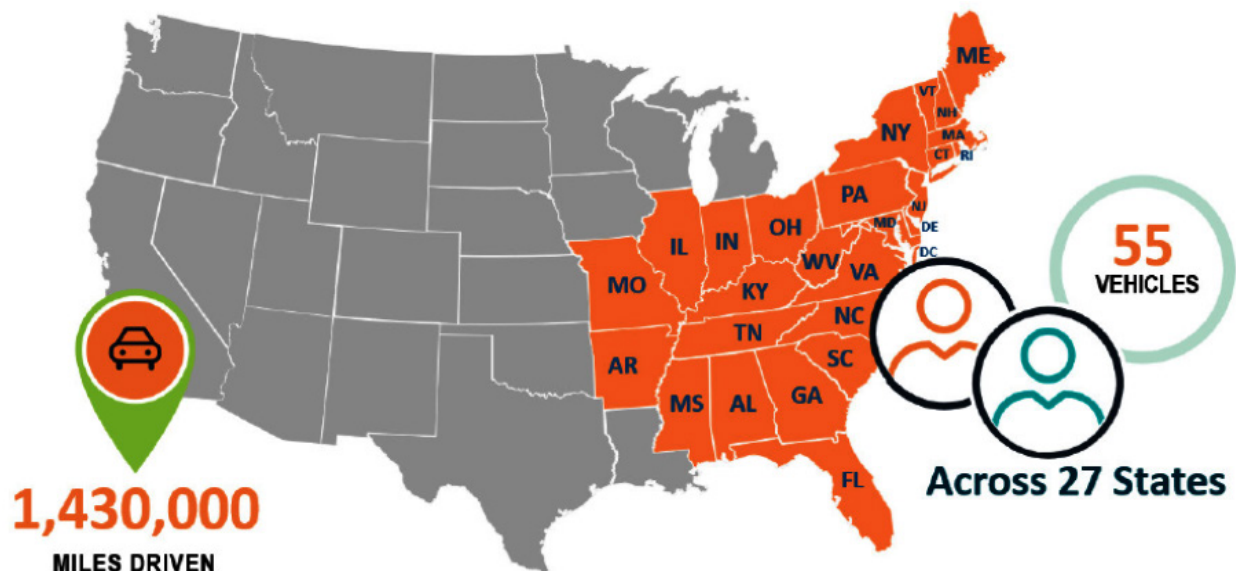
TETC's service provider was responsible for identifying commercial fleet participants and enrolling them in the pilot, including training and hardware installation. The criteria for participants included the following: registered with IFTA, headquartered in one of TETC States, representative of a range of fleet sizes, cover a variety of carrier types, and travel across State

lines. Class 7 (26,001–33,000 pounds) and class 8 (33,001 pounds or more) trucks from four fleet operators were included in the pilot.

During the pilot, TETC’s service provider collected and analyzed the truck pilot data, generating a statement for the four companies participating in the pilot. These statements included the number of participating trucks; average MPG for the pilot vehicles; number of States traveled through during the pilot; number of gallons purchased during the period; location (State) of these purchases; mileage driven by the fleet vehicles in each State (excluding the exemptions, as per IFTA); and a summary of estimated costs of fuel, Federal fuel tax, State fuel tax, and hypothetical MBUF. The statement was designed to show the fleet manager a comparison between the estimated costs under the current fuel tax system versus a potential MBUF approach.

Pilot Statistics

As shown in figure 3, during the 6-month pilot, an average of 55 participating trucks each month accumulated 1.43 million miles across 27 States. Of the 1.43 million miles driven, 1.34 million miles were accrued in TETC States.



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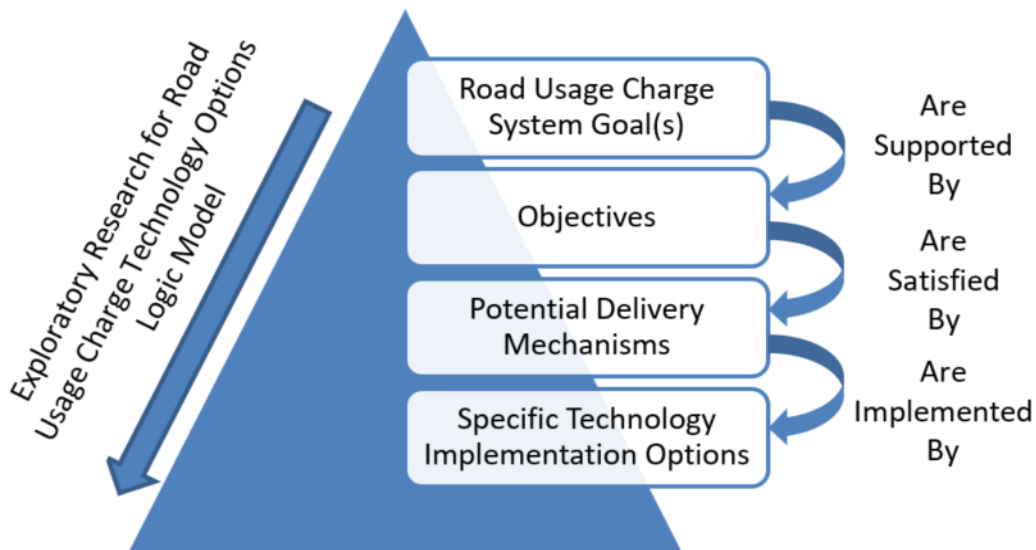
Figure 3. Illustration. States where mileage was accrued during Phase 2 truck pilot.

CHAPTER 3. INDEPENDENT EVALUATION METHODOLOGY

This chapter summarizes the independent evaluation approach and methodology. The evaluation team completed this work in coordination with FHWA Office of Operations, FHWA division office staff, and grantee site representatives. This chapter defines the evaluation framework and provides TETC responses to USDOT questions about RUC approaches, their viability, and characteristics if implemented nationally.

EVALUATION APPROACH

The RUC concept is that users pay a direct charge to use a roadway. The terms use and user can be defined in different ways, and the mechanism by which a charge is levied can also vary. This is evident among the Phase 2 grantee agencies, all of which are using different combinations of technologies, paradigms, and mechanisms to levy charges. The fundamental objective of the RUC system is a key factor in identifying technology options, data collection, and how fees are levied. Previous research has characterized this phenomenon through the use of an RUC logic model, as illustrated in figure 4.



Source: HDR Inc.

Figure 4. Diagram. Exploratory research for road usage charge technology options logic model.

A key component of this evaluation was to understand the fundamental objectives of the RUC systems as deployed by the grantee sites. The objectives provide insight into more detailed assessments and evaluations of the efficacy, costs, and scalability of the systems at a regional or national level. The “Evaluation Framework” section below provides a summary of how the evaluation team conducted this evaluation.

EVALUATION FRAMEWORK

U.S. Department of Transportation Questions

Table 3 presents key questions that the evaluation team examined as part of this effort. To explore the USDOT questions within the context of the grantee sites' proposed activities, the evaluation team elaborated on the questions and defined relevant metrics for conducting the evaluation. While some questions were found to be highly applicable to TETC's Phase 2 activities, others were marginally applicable.

Table 3. Mileage based user fee assessment framework.

No.	U.S. Department of Transportation Evaluation Question	Relevant Site Question/Metrics	Applicability to Eastern Transportation Coalition's Phase 2 Activities
Q1	What is the viability of implementing RUC on a nationwide scale?	What are the lessons learned from interstate pilot operations?	Medium
Q2	Would the fee assessment and collection mechanisms be scalable?	Not applicable (N/A)	Low
Q3	What is the efficiency of the fee assessment and collection relative to the fuel tax?	What are the costs of RUC collection for the pilot?	Medium
Q4	What are the attributes and characteristics of the RUC systems with respect to privacy, security, user acceptance, ease of use, ability to audit, charging accuracy, reliability, equity, ability for a user to circumvent the charge, and other factors?	System attribute specific questions	High
Q5	What are user and stakeholder perceptions of an RUC in general and of pilot activities?	What are some of the outcomes of public awareness campaigns? What input is provided by the steering committee?	High
Q6	What changes in institutional and financial setting, frameworks, models, and elements are required?	N/A	Low
Q7	What is the financial sustainability of each pilot deployment?	N/A	Low

Table 4 provides system attributes relevant to the evaluation. The attributes and their definitions are based on the description of the STSFA program in § 6020 of the FAST Act.¹⁰

Table 4. System attributes relevant to the road usage charge evaluation.

Functional Parameter	Description
Primary Parameters	
Charging accuracy, precision, repeatability, and reliability	The system’s ability to assess the expected charge for each use of the roadway; the system’s ability to repeatedly produce a consistent assessment of fees for identical travel; reliability focuses on system uptime; technical accuracy encompasses some of the secondary factors below, such as flexibility and ability to audit
Public outreach and communication	Communication to specific interest groups (e.g., those representing the heavy-vehicle industry or electric vehicles) and the public at large about shortcomings of the current motor fuel tax approach
Public acceptance	The degree to which system use is straightforward; the degree to which participant time spent interacting with the system is minimized; the level of acceptance by the traveling public
Interoperability	Ability of the system to interact and exchange information across multiple jurisdictions
Privacy protection	Protection of personal information; privacy refers to nature of the information being collected as opposed to the integrity of the information
Use of independent and third-party vendors	Benefits of and concerns with the use of third-party vendors for the administration and operation of the system
Congestion mitigation	Ability to incorporate congestion reduction strategies in the program
Equity	How user costs and other outcomes will impact people of different socioeconomic statuses, racial and ethnic identities, genders, English proficiency, and travel modes
Ease of compliance and enforcement; transparency; cost to user	How easily the system can be complied with or circumvented and the ability of law enforcement to identify travelers who have evaded the system; user awareness of what they are being charged; cost of equipment or installation to the end user and cost of the per-mile (or other) charge
Security (including cybersecurity) of technology	Data source integrity and storage and transmission and access; cybersecurity is the extent to which the system is vulnerable to a cyberattack or release of private information

¹⁰ Pub. L. No. 114–94.

Table 4. System attributes relevant to the road usage charge evaluation. (continuation)

Functional Parameter	Description
Secondary Parameters	
Ability to audit	Extent to which individuals can contest their charges and have visibility into how the charges were accrued and assessed
Flexibility and user choice	Ability of the technologies and systems to be upgraded or updated; choices of user-based alternative transportation revenue mechanisms, including the ability of users to select from various technology and payment options
System costs	The full spectrum of investment costs, including initial capital, operating, and maintenance costs

EVALUATION PROCESS

The evaluation team devised an approach that involved multiple steps to meet the goals set out for this independent evaluation. The scope of this evaluation did not include independent data collection or an audit of individual site programs. The process involved the collection of data and information from the grantee sites. Specifically, the evaluation team:

- Reviewed quarterly and annual reports submitted by grantee sites to FHWA
- Developed detailed questionnaires to collect information through interviews at periodic touch points, either virtually or on-site
- Facilitated meetings to share information, findings, and progress and for the evaluation team to ask questions
- Participated in the pilot to observe and document user experience where possible and relevant
- Customized the evaluation framework based on specific grantee goals and program aspects
- Facilitated roundtables with grantee site representatives during Transportation Research Board annual meetings in 2018, 2019, and 2020 for crosscutting discussion on USDOT's STSFA program goals
- Conducted detailed review of the final reports prepared by grantee sites on pilot completion; in addition to the overall evaluation report, grantee sites typically prepared multiple reports addressing aspects of the pilot, such as technology, public communication, and public perception; where needed, the evaluation team sought additional data in surveys conducted by grantee sites

Evaluation Process Key Milestones

The following are key milestones in the evaluation process:

- **Kickoff meeting.** At the start of the evaluation, the evaluation team conducted 90-minute kickoff meetings with each grantee site in the fall of 2017. These meetings were aimed at

informing the evaluation team's initial study. The meetings served as a forum to introduce the goal and scope of the evaluation and to obtain information about the goals, scope, and timeline of Phase 1. The evaluation team requested program documents that had been compiled up to that point, as well as updated project management plans.

- In-person meeting with key personnel. In December 2019, the evaluation team met with key personnel to hear updates about lessons learned in Phase 2 and a brief overview of Phase 3 activities.
- Virtual meeting: In December 2020, the evaluation team attended a virtual meeting to ask several questions about the recently completed Phase 2 pilots and plans for the upcoming Phase 3 pilots.

CHAPTER 4. INDEPENDENT EVALUATION FINDINGS—PASSENGER VEHICLE PILOT

This chapter presents findings and lessons learned from TETC’s Phase 2 passenger vehicle pilot. The findings are the result of an independent evaluation conducted according to the framework described in chapter 3. These findings pertain to the Phase 2 pilot performed with funds from the STSFA program, awarded in FY 2017.

TECHNICAL ACCURACY, PRECISION, AND REPEATABILITY

Legitimacy of an MBUF system rests on the technical accuracy of mileage reporting, and the reliability of the system to assess the expected charge for each use of the roadway and repeatedly produce a consistent assessment of fees for identical travel. This section discusses findings regarding technical accuracy, precision, and repeatability of the MRMs. Table 5 presents the evaluation and site-specific questions about technical accuracy, precision, and repeatability.

Table 5. Evaluation and site-specific questions used to assess technical accuracy, precision, and repeatability of mileage reporting methods (MRMs).

Evaluation Question	Site-Specific Questions and Metrics
What options were available to participants to report miles-driven data?	What MRMs were provided in the pilot? What low-technology options were tested in the pilot? How did the public respond to these options?
What is the technical accuracy of the MRMs used?	What were the findings regarding technical accuracy of the MRMs provided to pilot participants?
Where were the findings regarding TETC system’s flexibility to adapt?	How was the system configured? Does this configuration allow the system to adapt? Can the system accommodate various types of MRMs? Can the system include private vendors?

Mileage Reporting Methods and Public Response

What Mileage Reporting Methods Were Provided in the Pilot?

The Phase 2 passenger vehicle pilot used a single private account manager that offered the following two MRMs:

- **GPS-enabled OBD-II.** OBD-II devices that use GPS include a mechanism on top of the data available from the OBD-II to measure distance driven. Mileage collected was differentiated by the State where the vehicle was driven. The net mileage fee was based on each State’s per-mile rate, minus a credit for the State fuel tax for the estimated gas consumed in each State.
- **Non-GPS-enabled OBD-II.** The non-GPS OBD-II devices use data from the vehicle’s diagnostic system to determine miles driven. Vehicle OBD-II data do not include the cumulative miles driven as a vehicle’s odometer does. Rather, it calculates mileage from

the data available while the device is installed, such as the rotation of the vehicle's wheels. Similar to the vehicle's odometer, this device is subject to the same variables that affect the tolerance of the measurement. This method involved some assumptions regarding interstate travel. TETC assumed a certain percentage of mileage and fuel tax payments to have occurred in the participating vehicle's home State. Details of this approach are provided in the "Interoperability" section. A shortcoming of this approach is the calculation of in-State versus out-of-State travel, which is based on an assumption rather than actual miles driven.

What Were the Low- or No-Technology Options Provided in the Pilot?

TETC's Phase 2 passenger vehicle pilot did not include a low- or no-technology option for mileage reporting.

Technical Accuracy of Mileage Reporting Methods

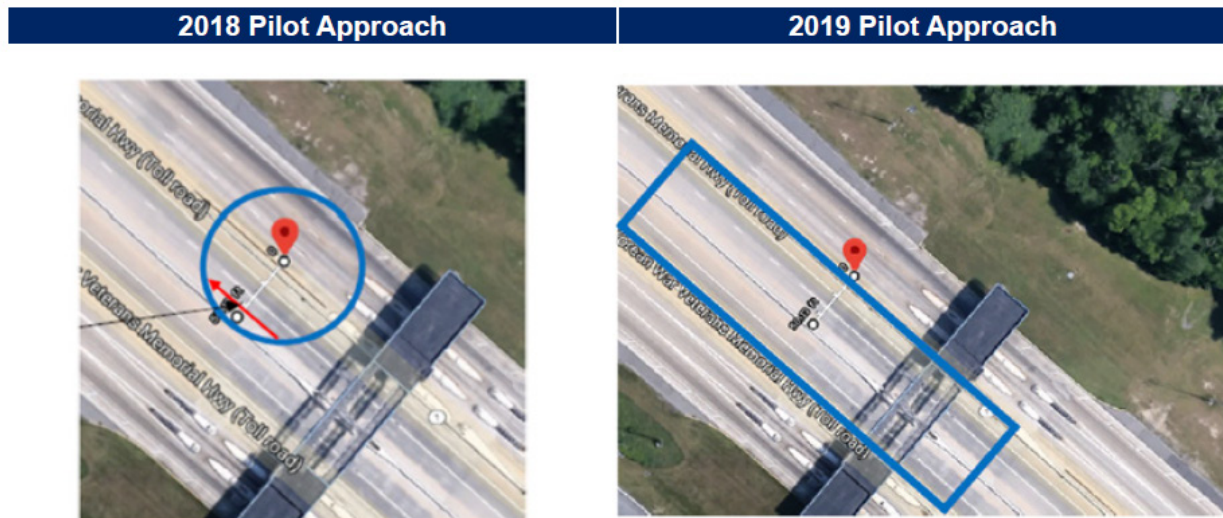
What Were the Findings Regarding Technical Accuracy of the Mileage Reporting Methods Provided to Pilot Participants?

For non-GPS OBD-II devices, mileage was calculated from vehicle diagnostic data. This approach computes mileage using data such as the rotation of the vehicle's driveshaft. A limitation of this MRD is that it will be as accurate or precise as the data from the vehicle's diagnostic technology, such as the odometer. No current law in the United States holds vehicle odometers to a certain accuracy. However, the National Institute of Standards and Technology (NIST) offers a tolerance level that vehicle odometers should remain within to be considered correct. NIST recommends a tolerance of 4-percent under and over actual mileage for vehicle odometers.¹¹ A number of variables can affect these tolerances, including tire size (if different from what was original to the vehicle), tire inflation, tire wear, temperature, vehicle loading, and number of passengers.

TETC tested the accuracy of the GPS-enabled OBD-II devices on multiple toll facilities. The testing was aimed to determine the potential application of this reporting method to assess tolls. Accuracy of vehicle location is a key requirement for tolling because the ability to detect the position of vehicles in specific lanes is necessary to accurately assess tolls. For example, the device would need to differentiate drivers using an express lane versus drivers using an adjacent general purpose lane.

Using a rectangular geofenced area in the Phase 2 pilot raised the accuracy to 90-percent when compared to E-ZPass® Group data. The final report indicated the majority of the errors came from a handful of tolling points. This was an improvement over the Phase 1 pilot, which tested a circular geofenced area to detect vehicle travel with a 50-percent accuracy when compared to E-ZPass® Group data. See figure 5 for a comparison of approaches in the two pilots.

¹¹ NIST, *Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices – As Adopted by the 92nd National Conference of Weights and Measures 2007* (Washington: U.S. Department of Commerce, 2008), section 5.53, pages 5–13.



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Figure 5. Photograph. Mileage-based user fee toll point development approaches for Phase 1 (2018 pilot) and Phase 2 (2019 pilot).

How Did the Public Respond to These Options?

Approximately 80-percent of participants in the Phase 2 pilot chose an MRD with GPS location capabilities. In surveys and focus groups, most pilot participants stated that they found the GPS device more useful. There was no significant difference among Pennsylvania and Delaware pilot participants regarding their device preference or satisfaction.

The majority of focus group participants who chose the GPS-enabled device cited the following reasons for doing so:

- Desire to provide more useful data to researchers to enhance the quality of research
- Desire to obtain information regarding in-State and out-of-State personal travel

Most focus group participants were satisfied with their plug-in device with GPS. They cited the ease of using the technology, the accuracy of the information generated, and their overall satisfaction with the device more generally.

The minority of focus group participants who chose the device without GPS cited the following reasons for doing so:

- Concerns about privacy
- Disinterest in obtaining information beyond total miles traveled

A minority of pilot participants stated in focus groups that on occasion their devices did not register trips or that the device had stopped working. Some pilot participants complained of receiving too many emails. Many participants lost or failed to save the box in which to return the device.

How Was the System Configured? Does This Configuration Allow the System to Adapt?

The Phase 2 pilot used a private third-party account manager that provided two mileage reporting options for participants.

Can the System Accommodate Various Types of Mileage Reporting Methods? Can the System Include Private Vendors?

The Phase 1 pilot included additional MRMs, such as smartphone and vehicle telematics. For the Phase 2 pilot, the options were limited to OBD-II devices, with technology limitations, cost, or concerns with reporting accuracy cited as the key reasons to limit MRMs.¹² The pilot used a single private account manager to deploy mileage reporting technology, calculate fees, and manage user accounts. For the pilot, no money was paid or exchanged by users.

Key Findings on Technical Accuracy, Precision, and Repeatability of Mileage Reporting Methods

Providing a broad range of technology options to report mileage allows drivers to make trade-offs according to their needs, preferences, abilities, and sensitivities. The following are key findings of TETC's Phase 2 pilot regarding MRDs:

- The GPS-enabled OBD-II device was accurate enough to identify vehicles within a tolling express lane with 90-percent accuracy, compared to the RFID transponder. This suggests the technology could potentially support interoperability between MBUF and tolling.
- The non-GPS OBD-II device will still be subject to the same level of accuracy as the vehicle's odometer, which is subject to a number of variables as outlined previously in the report that can affect accuracy.

PUBLIC OUTREACH AND COMMUNICATION

This section analyzes TETC's efforts to communicate the MBUF concept to the public and to specific groups targeted for recruitment and enrollment. Table 6 presents the evaluation and site-specific questions about public outreach and education.

Table 6. Evaluation and site-specific questions used to analyze mileage-based user fee public outreach strategies.

Evaluation Question	Site-Specific Questions and Metrics
What strategies were used to recruit participants for the pilot?	What strategies were used to inform and educate the general public about the concept of road usage charges and the Phase 2 pilot? How effectively did these strategies succeed in recruiting pilot participants and increasing public awareness and acceptance?

¹² TETC, *Mileage-Based User Fee Exploration 2019 Passenger Vehicle Pilot* (2021), 5.

What Strategies Were Used to Recruit Pilot Participants?

TETC undertook a 4-month public outreach effort to recruit pilot participants, beginning in May 2019. The effort was designed to recruit key stakeholders plus participants who reflected the diversity of Pennsylvania and Delaware in terms of geography (urban, rural, urban cluster), age (18-34, 35-54, 55+), and vehicle type (internal combustion engine (ICE), hybrid, and electric vehicles). TETC used specific targets for each category. TETC selected these particular data fields based on data availability from the 14 participating States. The source information for demographic (age) data was the U.S. Census 2018 American Community Survey (ACS) 5-year estimates. Vehicle type targets were set based on publicly available information on EV ownership, and participating States provided targets by geographic location.

TETC used the following strategies for public communication:

- Creation and maintenance of a website (<https://tetcoalitionmbuf.org/>) with the following information:
 - Pilot fact sheet
 - Frequently asked questions
 - Video explaining transportation funding concepts, the MBUF concept, and TETC's pilot
 - MBUF cost calculator
- Social media awareness campaign
- Postcard distribution
- Media releases, media interviews, and posting on department of motor vehicles television screens
- Postings on department of motor vehicles television screens
- A \$10 gift card for non-government participants who enrolled
- State agencies, including PennDOT and the Pennsylvania Office of Administration, shared recruitment materials with partners and stakeholders; DelDOT conducted outreach to metropolitan planning organizations, industry interest groups, and academics encouraging them to sign up and invite members to participate

TETC also extended pilot invitations to additional member States, ultimately recruiting approximately 20-percent of the participant pool from outside of Pennsylvania and Delaware.

How Effectively Did These Strategies Succeed in Recruiting Pilot Participants and Increasing Public Awareness and Acceptance?

A total of 889 pilot participants were recruited from 14 coalition States and Washington, DC. Twenty percent of participants were key stakeholders identified across coalition States, and 80 percent were from the general public in Delaware and Pennsylvania. For the latter group, specific targets were developed to ensure a diversity of participants according to three characteristics: location, age, and vehicle type. Table 7 shows the demographic breakdown of participants as compared to recruitment targets. The number of participants was very close to the target for all metrics except age. In both States there was an oversampling of participants between the ages of

35 and 54, with a corresponding under-sampling of participants between the ages of 18–34 and participants 55 years and older.

Table 7. Passenger vehicle pilot participant demographics and vehicle types for Pennsylvania and Delaware.

Demographic	Range	Pennsylvania		Delaware	
		Target (%)	Actual (%)	Target (%)	Actual (%)
Location	Urban	71	76	68	64
	Rural	22	19	17	20
	Urban cluster	8	5	15	15
Age	18–34	29	22	28	14
	35–54	32	51	33	53
	55+	39	27	39	13
Vehicle type	ICE/diesel	96	94	96	91
	Hybrid	2	5	2	8
	Electric	2	1	2	1

Source: Adapted from TETC’s *Mileage-Based User Fee Exploration: 2019 Passenger Vehicle Pilot* (2021).

Note: Urban, rural, and urban cluster are based on census definitions as follows: urban – densely settled core of census tracts and/or census blocks of 50,000 or more people; urban cluster – settled core of census tracts and/or census blocks of at least 2,500 and less than 50,000 people; rural – all population, housing, and territory not included within in an urban or urban cluster area.

Key Findings on Public Outreach and Communication

Given limited public knowledge about transportation funding topics, TETC used a multipronged approach including broad-based media strategies, social media campaigns, and specific stakeholder outreach by State agencies for pilot enrollment.

Future pilots may benefit from public opinion surveying that oversamples respondents from populations of interest (e.g., by income or race) so the views of these groups can be assessed with some certainty. Similarly, future pilots may also benefit from a pilot participant recruitment plan designed to ensure inclusion of a diversity of participants across race, income, English language proficiency and other demographic dimensions.

PUBLIC PERCEPTION AND ACCEPTANCE OF ROAD USAGE CHARGE

This section presents findings regarding public acceptance and opinions of the MBUF concept as a transportation funding mechanism. TETC’s research methods provided insight into public perception and acceptance of MBUF as a transportation funding mechanism before, during, and after the pilot. The surveys and focus groups conducted also shed light on specific concerns related to the pilot program and implementation aspects of a potential live program.

Table 8 presents the evaluation questions and TETC-specific questions regarding public perception and acceptance of MBUF.

Table 8. Evaluation and site-specific questions used to evaluate public perception and acceptance of mileage-based user fee (MBUF).

Evaluation Question	Site-Specific Questions and Metrics
What research methods were used to assess public perception and acceptance of MBUF?	• What research methods were used to collect public opinion data? ○ What was the timing of the data collection? Were data collected prior to, during, and after the pilot? ○ From whom was the data collected (pilot participants, the general public, and/or targeted groups of the public)? • Were there analyses looking specifically at the opinions and understanding held by members of populations based on income, race, ethnicity, gender, or English language proficiency?
What were the findings regarding public awareness and support for MBUF?	• Was the public aware of the MBUF concept in general and the State's pilot in particular? Did people support the MBUF concept in general and the pilot approach in particular?
What were the findings regarding public understanding about key MBUF aspects?	• What opinions did people hold on specific matters related to the MBUF concept? ○ The need to transition to a more sustainable funding source than the current gas tax ○ Flexibility and user choice in a potential MBUF system ○ Privacy and security of data in a potential MBUF system ○ Equity and progressivity of a potential MBUF system. ○ Confidence that users will comply (versus evade) an MBUF • What opinions did people hold on specific matters listed above about the version of the MBUF that was piloted? • Did they have other concerns about an MBUF? • Did they see other benefits to an MBUF?

The findings in this section are primarily sourced from two reports:

- The Eastern Transportation Coalition. (2021). Mileage-Based User Fee Exploration: 2019 Passenger Vehicle Pilot. Published March 01, 2020.
- DHM Research. (2019). I-95 MBUF: Focus Group and Participant Surveys- Summary.

Public Awareness, Perception, Acceptance, and Support of Road Usage Charge

What Research Methods Were Used to Collect Public Opinion Data?

- What was the timing of the data collection? Was data collected prior to, during, and after the pilot?
- From whom was the data collected (pilot participants, the general public, and/or targeted groups of the public)?

TETC gathered public opinion data from the general public in Pennsylvania and Delaware with a survey administered prior to the start of the pilot. Participants' opinions were gathered through pre- and post-pilot surveys and focus groups.

The views of the general public in Pennsylvania and Delaware were assessed through a phone survey conducted in 2019. A sample was recruited with 500 respondents from each State, for a total of 1,000 respondents. TETC used a three-step process to assess pilot participant opinions:

- Pre-pilot participant survey: TETC administered a survey at the beginning of the pilot after participants had enrolled and installed their devices. The survey focused on capturing participants' attitudes about the enrollment and onboarding processes, driving and fueling habits, baseline attitudes about MBUF, and knowledge of transportation funding. The survey was completed by 1,000 adults—500 adults each from Pennsylvania and Delaware.
- Post-pilot participant survey: This survey was administered after the pilot had been completed. It focused on participants' response to the accuracy of the data collected, overall experience, changes in driving behavior, efficacy of pilot incentives, and their experience with the account manager and TETC. It also provided a final update on attitudes about MBUF.
- Focus groups after the pilot: Two focus groups were held in Pennsylvania and two were held in Delaware in different locations at the completion of the pilot. Focus group participants were recruited from a list of pilot participants. TETC strived to include a diversity of participants by gender, age, socioeconomic status, political orientation, and racial and ethnic identity. TETC also strived to include a mix of participants from urban, suburban, and rural areas; drivers of older and newer vehicles; drivers of gas/diesel, hybrid, plug-in hybrid, and electric vehicles; and participants who drive an average of 10 miles or fewer, 11–45 miles, or more than 50 miles.

Did the Research Methods Permit Analysis of Populations Based on Low-Income or Non-English-Speaking Residents?

The survey methodology used for the survey of Pennsylvania and Delaware residents used sampling quotas and data weighting by age, gender, area of State, and ethnicity to build a representative sample. However, populations based on income, race, ethnicity, gender, or English language proficiency were not within the scope of TETC's Phase 2 exploration, and were not oversampled, so it is unlikely that their views could be assessed with any certainty. Also, the survey was offered in English only.

Was the Public Aware of the Road Usage Charge Concept in General, and the State's Pilot in Particular? Did People Support the Road Usage Charge Concept in General, and the Pilot Approach in Particular?

General public: The Delaware and Pennsylvania statewide surveys conducted in 2019 found that 76-percent of respondents were unfamiliar with the MBUF concept; 55-percent were “not at all” familiar, and 20-percent were “not too familiar.” The surveys also found that 74-percent of respondents erroneously believed transportation funding is not decreasing. According to TETC, these beliefs pose a challenge for policymakers since it is harder to change the transportation funding mechanism with a goal to increase revenues when residents do not perceive funding to be a problem or concern.

Pilot participants: The pilot participants received a monthly statement that provided fuel costs separated from Federal and State fuel taxes, as well as the estimated MBUF for that month. TETC determined through surveys conducted in the pilot that willingness to shift to an MBUF approach is linked to this positive pilot experience. Post-pilot surveys found that the majority of pilot participants (79-percent) were either satisfied or very satisfied with the pilot in general.

The following are relevant findings regarding public level of acceptance based on the focus group and surveys:

- The major reasons for participation in the pilot included a desire to share opinions on funding with policymakers, to learn more about how transportation is funded, and to understand how much is paid in fuel taxes.
- Over the course of the pilot, participants became slightly more supportive of MBUF. Surveys conducted during the pilot asked participants to rate their approval of MBUF on a five-point scale, with one-point representing “I don’t like the concept at all” and five-point representing “I really like the concept.” Participants’ average approval rating grew from 3.77 at the beginning of the pilot to 3.94 at the end. When the pilot ended, 67-percent of participants had a positive opinion (a rating of 4 or 5) of MBUF.
- When asked how policymakers might encourage greater enrollment in pilots, focus group participants suggested that emphasis be placed on how easy it is to enroll and use the technology.

Public Opinions about Key Program Aspects

What Opinions Did People Hold on Specific Matters Related to the Mileage-Based User Fee Concept?

TETC asked survey takers about MBUF guiding principles in all surveys and focus groups. The following findings emerged:

- MRM: Most pilot participants opted to use the MRD with location. Key reasons cited included precision, ability to take advantage of value-added amenities, and ease using the plug-in device.
- Simplicity: Focus group participants who were highly satisfied with their pilot experience emphasized the ease of using the provided technology.

- Monthly billing statements: Most pilot participants found the monthly statements as accurate, useful, clearly communicating the amount billed, and providing adequate information to compare MBUF to fuel tax paid. A majority of participants also considered the number of miles recorded to be “fairly accurate.”
- Privacy: In focus groups, a majority of participants voiced satisfaction with data privacy and security protections. A minority of focus group participants had strong concerns about the collection of personal information regarding how many miles and where and how they drive. They viewed the collection of these data as compromising their privacy. Several of these participants opted for the non-location-based mileage reporting option.
- Value-added amenities: Participants responded to value-added amenities, such as the visual trip log, driving score application (app), safe zone app, vehicle health app, parked car app, mobile claims app, and automated emissions monitoring. While these amenities were of moderate interest to most pilot participants at the outset, by the end of the pilot, their perceived utility of these amenities dropped. Visual trip logs emerged as the most favored value-added amenity in focus groups.
- Fairness and equity: The surveys and especially the focus groups explored fairness and equity at some length. Among the key findings were that people generally thought it was fair for everyone to pay for the roads. Many thought the charge should be lower for people driving hybrid or electric vehicles. Equity findings are discussed in detail in the “Equity Analysis” section.

Key Findings on Public Perception and Acceptance of Mileage-Based User Fee

The pilot led to a marginal increase in participant support for adopting MBUF as the primary transportation funding source. The pilot did not significantly change participants’ attitudes toward fairness of MBUF overall. However, it decreased participants’ uncertainty and slightly increased confidence that MBUF is fairer than fuel taxes. The surveys and focus groups confirmed that fairness and the concept of “pay for what you use” is the strongest argument in favor of an MBUF. The pilot helped increase participants’ appreciation for certain aspects of an MBUF, such as a relatively lower tax burden for low fuel-efficient vehicles.

The pilot successfully provided the TETC with insights into participants’ preferences, such as an MRD with location data collection capability, despite their privacy concerns. It also provided insight into other participant concerns such as fairness for all users and for specific categories of users (e.g., rural drivers, low-income drivers, drivers of fuel-efficient vehicles.)

INTEROPERABILITY

The eastern seaboard features high population densities within States of smaller geographic areas compared to western States. Because cross-State travel is common on the eastern seaboard, interoperability was a key feature explored in Phase 2. Table 9 provides the evaluation and site-specific questions to assess interoperability and reconciliation aspects of the Phase 2 pilot.

Table 9. Evaluation and site-specific questions used to evaluate mileage-based user fee pilot interoperability and reconciliation.

Evaluation Question	Site-Specific Questions and Metrics
Did the system support interoperability across jurisdictions?	How was interoperability tested?
Where were the findings regarding the system's interoperability?	What mileage reporting methods support interoperability? How were funds reconciled across jurisdictions?
Can a mileage-based-fee be interoperable with other transportation revenue collection mechanisms?	Was the system's interoperability with other revenue mechanisms tested? What were the findings?

Aspects of the Pilot Program Demonstrating Interoperability

How Was Interoperability Tested?

The pilot used the existing State motor fuel tax as a benchmark for calculating the per-mile rate for each State using the national fuel economy average of 22 MPG and 19-percent of administrative costs added. Because participants would already be paying a motor fuel tax with the purchase of fuel, the system calculated the credit that would be applied to the calculation of an MBUF. Participants using the GPS-enabled device were provided monthly statements that showed the mileage driven in each State multiplied by the per-mile fee estimated in each State (see table 10), minus the fuel tax credit. Participants were shown the fee breakdown and cumulative fee their driving had generated both in their home State and within States that would have different mileage charges.

Table 10. Per-mile user fee rates and fuel tax credits for all coalition States.

State	Per-Mile Rate (Cent per Mile)	Fuel Tax Credit (Cent per Gallon)
Connecticut	1.99	36.85
Delaware	1.25	23.00
Washington, DC	1.27	23.50
Florida	2.27	41.99
Georgia	1.90	35.28
Maine	1.62	30.01
Maryland	1.91	35.30
Massachusetts	1.44	26.54
New Hampshire	1.2 9	23.83

Table 10. Per-mile user fee rates and fuel tax credits for all coalition States. (continuation)

State	Per-Mile Rate (Cent per Mile)	Fuel Tax Credit (Cent per Gallon)
New Jersey	2.24	41.40
New York	2.39	44.10
North Carolina	1.97	36.45
Pennsylvania	3.18	58.70
Rhode Island	1.84	34.00
South Carolina	1.12	20.75
Vermont	1.69	31.19
Virginia	1.12	20.66

For participants who chose the non-GPS OBD-II device, TETC estimated the proportion of total miles driven out of State using census data and calculated a blended rate that accounted for the different rates in neighboring States. The rate was calculated by applying the participant's State of residence per-mile rate and fuel tax to this estimated in-State mileage. The remaining percentage of the vehicle's mileage was assumed to have been driven in States adjacent to the participant's home State. For the mileage estimated to have been driven in adjacent States, the average per-mile fee and average fuel tax for out-of-State mileage were based on a blended or weighted per-mile rate and State fuel taxes in adjacent States (see table 11).

Table 11. Assumed percentages of out-of-State mileage by in-State vehicles and associated out-of-State per-mile rates and fuel taxes used for plug-in device without location option.

State	Out-of-State Mileage by Resident Drivers (%)	Out-of-State per-Mile Rate (cent per mile)	Out-of-State Fuel Tax Credit	Assumptions for Out-of-State Rates and Fuel Taxes
Connecticut	8	2.01	37.19	NY (50%), RI, MA
Delaware	18	2.63	48.53	PA (50%), NJ, MD
Washington, DC	30	1.51	27.98	VA, MD
Florida	1	1.91	35.28	GA
Georgia	3	1.70	31.37	SC, FL
Maine	5	1.36	25.19	NH, MA
Maryland	20	1.50	27.71	DC (35%), VA (35%), PA, DE
Massachusetts	5	1.88	34.70	CT, NH, RI, NY
New Hampshire	18	1.55	28.57	MA (50%), VT, ME

Table 11. Assumed percentages of out-of-State mileage by in-State vehicles and associated out-of-State per-mile rates and fuel taxes used for plug-in device without location option. (continuation)

State	Out-of-State Mileage by Resident Drivers (%)	Out-of-State per-Mile Rate (cent per mile)	Out-of-State Fuel Tax Credit	Assumptions for Out-of-State Rates and Fuel Taxes
New Jersey	15	2.78	51.40	NY, PA
New York	4	2.1 2	39.13	NJ, CT
North Carolina	3	1.1 2	20.71	VA, SC
Pennsylvania	6	1.95	35.95	DE, MD, NJ, NY
Rhode Island	16	1.72	31.70	CT, MA
South Carolina	5	1.94	35.87	GA, NC
Vermont	8	1.84	33.97	NH, NY
Virginia	10	1.59	29.40	DC, MD

Data from TETC’s Phase 1 passenger vehicle pilot indicated the estimates did not accurately represent the actual mileage data generated by participants, and that more work should be completed to understand an appropriate way to measure and estimate interstate travel. TETC recognized that data generated from users with GPS-enabled OBD-II devices could support a further refinement in understanding interstate travel, where their travel patterns are used to inform estimates of other users who chose the non-GPS OBD-II device.

Findings Regarding the Pilot System’s Interoperability

What Mileage Reporting Methods Tested Support Interoperability?

The GPS-enabled OBD-II device has the ability to measure the location of miles driven, a key feature in supporting interoperability among States. The non-GPS OBD-II device does not measure location of miles driven. TETC developed an approach to estimate the miles driven out of State and a fee structure to reflect the estimated travel patterns.

How Were Funds Reconciled across Jurisdictions?

TETC reconciliation of funds between jurisdictions was not explored as part of the pilot. The development of a per-mile interstate funding structure, however, would support the eventual reallocation of funds, as each account manager would be collecting funds from each participant on behalf of the States they travel through.

A key issue raised in the *Mileage-Based User Fee Study: Out-of-State Mileage Technical Memorandum* was that moving from the motor fuel tax to an MBUF system could potentially cause shifts in funding for States. For example, a driver who purchases fuel in his or her home State will pay the motor fuel tax to that State for all miles driven with the fuel purchased, which is explained in the technical memorandum on this topic: “A fundamental shift that MBUF would

create is linking transportation system revenue to the actual use of the roads versus where fuel was purchased.”¹³

If a portion of those miles are out of State, then all of the tax revenue still goes to wherever the fuel was purchased. Under an MBUF, the fees would go to whichever State the mileage was driven within, which could potentially change the revenue collected by each State. This is summarized in the *Out-of-State Mileage Technical Report*. “Nevertheless, the simple analysis highlighted that how MBUF is implemented could result in some States becoming net gainers in revenue, while other States could become net revenue losers from a MBUF system, depending on the levels of out-of-State mileage.”¹⁴

Is the Mileage-Based User Fee System Interoperable with Tolling?

An area explored in the Phase 1 and Phase 2 passenger vehicle pilots was the integration of MBUF with the existing tolling systems throughout the eastern seaboard. With funds from more than 3,000 miles of toll roads going to State DOTs, tolling is an important source of revenue that occurs all along the eastern seaboard. As such it was pertinent that a study about a potential transportation funding mechanism explore interoperability with an existing revenue collection system.

TETC explored the potential to use MBUF technologies to calculate tolls and potentially integrate the tolling fees into a consolidated payment that would include MBUF. The pilots tested tolling facilities in Delaware and Maryland, using geolocation to identify vehicles that had passed through the express lanes of the toll facility. Each vehicle also had an existing transponder to verify the accuracy of the MBUF technology. In the Phase 1 pilot, the MBUF technology was able to determine whether a vehicle would be charged a toll with an accuracy of 56-percent when compared to the tolling statements but reached up to 90-percent in the Phase 2 pilot. The increase in accuracy from Phase 1 pilot to Phase 2 pilot was accounted for by the shape of the geofenced area used to determine whether a vehicle had passed through a specific area within a toll plaza (rectangles were more accurate than circles).

Key Findings on Interoperability and Reconciliation

TETC recognizes the need for interoperability of a future MBUF system. The eastern seaboard includes several large urban centers, often spread across many State boundaries. For a fair application of an MBUF, interstate travel would need to be accounted for. Understanding how out-of-State mileage may be estimated and applied to calculate a rate is a key requirement for offering MRDs that do not collect location information from drivers. TETC’s Phase 1 analysis indicated that estimates of out-of-State travel did not accurately represent actual miles driven by participants by State. For Phase 2, TETC devised a rate calculation mechanism to consider interstate travel based on census data about travel in the region. However, more analysis may be needed to understand and account for interstate travel for drivers who choose non-GPS-enabled MRDs.

¹³ I-95 Corridor Coalition, *Mileage-Based User Fee Study: Out-of-State Mileage Technical Memorandum* (2019), 5.

¹⁴ I-95 Corridor Coalition, *Out-of-State Mileage Tech Memo* (2019), 5, https://tetcoalitionmbuf.org/wp-content/uploads/2020/07/Coalition-MBUF-Out-of-State-Mileage-Tech-Memo_2019.pdf.

The potential to integrate MBUF technology into tolling could allow for a streamlined, consolidated approach to reporting and administering fees for both systems. The pilot suggests MBUF technology could potentially be used in tolling applications but it may require additional study and piloting.

PUBLIC PERCEPTION OF PRIVACY AND DATA SECURITY

This section discusses data privacy and technology security in Phase 2. Key aspects related to this topic include identification of privacy-related MBUF data collected and managed in TETC pilot, and key findings regarding public perception of MBUF privacy. Table 12 provides the evaluation and site-specific questions about privacy protection and technology security.

Table 12. Evaluation and site-specific questions used to assess mileage-based user fee (MBUF) data privacy protection and the reliability and security of technology.

Evaluation Question	Site-Specific Questions and Metrics
What types of data were required to be collected as part of the pilot?	Types of sensitive participant information collected as part of the pilot?
What is the public perception of privacy and data security of an MBUF system?	How important was privacy as a consideration to the MBUF pilot participants? How important was data security as an MBUF principle? What opinions did users of an automatic mileage reporting device have concerning privacy?
What are the pilot's findings on legal protections of privacy in an MBUF system?	What are the key goals and recommendations of TETC's proposed privacy policy?

Types of Data Collected

What Types of Data Were Required to Be Collected as Part of the Eastern Transportation Coalition's Mileage-Based User Fee Pilot?

TETC's pilot required collecting identifying information, financial and accounting information, and distance traveled information, such as when and where distances were traveled, depending upon the type of MRD. Table 13 presents the data type collected as part of the Phase 2 pilot.

Table 13. Types of data collected for the mileage-based user fee pilot by mileage recording device type.

Data Collected	Plug-in Device with Location	Plug-in Device without Location
Total miles driven and duration driven	x	x
Miles driven by State	x	
Miles driven by route	x	
Value-added amenity: vehicle diagnostic data, including information about the reason for “check engine” light and batter health information	x	x
Value-added amenity: driving quality	x	x
Value-added amenity: location of vehicle to help guide users back to their vehicles using a smartphone	x	

Public Perception of Privacy in the Mileage-Based User Fee System

One of the means to address privacy concerns about the information collected in the pilot was to give participants the choice of multiple MRDs. The next section summarizes key findings from surveys and focus groups about public perception of MBUF data privacy.

How Important Was Privacy as a Consideration to the Pilot Participants?

From the pre-pilot survey conducted by TETC, it was apparent that increasing the understanding of how the pilot will protect privacy and keep personal data secure was not a highly motivating factor for participants. Only 24-percent of respondents considered this aspect “very motivating,” with an additional 22-percent considering it “somewhat motivating.” Participant concerns about privacy and data security decreased after MBUF pilot participation. The percentage of participants who ranked “privacy and security of my personal data” as a high concern dropped from 49-percent in the pre-pilot survey to 20-percent in the post-pilot survey.

What Opinions Did Users of Automatic Mileage Reporting Device Have Concerning Privacy?

In focus groups, a majority of participants voiced satisfaction with these data protections. Only 3-percent were “not too satisfied.”

- 36-percent of respondents were “very satisfied” with data protections in the pilot. In the focus groups, these participants appreciated not being required to provide extensive personal data to participate. They also appreciated the option to decline location tracking.
- 24-percent of respondents were “somewhat satisfied” and expressed concerns that data might still potentially “get into the wrong hands.”

- 36-percent of respondents “never thought about [the concerns]” until the focus group. This group either was accustomed to or resigned to the fact that so much of their personal data are already available.¹⁵

Key Findings on Privacy and Data Security

The topic of data security was not the primary motivation among pilot participants. However, pilot participation helped alleviate concerns about data privacy and security among participants.

CONGESTION MITIGATION

Congestion mitigation was not a focus area of TETC’s Phase 2 pilot and was not studied as part of the rate structure or public perception analysis.

EASE OF COMPLIANCE AND TRANSPARENCY

This section presents findings regarding ease of compliance, transparency, and user awareness of cost, in accordance with the questions in table 14. Ease of compliance refers to how easily the system can be complied with or circumvented, and the ability of program managers or law enforcement to identify evasion. Transparency refers to user awareness of what they are being charged and the basis for the charge.

Table 14. Evaluation and site-specific questions used to analyze the ease of road usage charge system compliance and the transparency of cost information.

Evaluation Question	Site-Specific Questions and Metrics
What compliance mechanisms were explored in the pilot?	How did the system enforce compliance?
Was it easy for users to comply with the system?	What level of effort was required of users? Were differences were observed in the mileage reporting approaches tested?
What information was communicated to the driver and at what frequency?	Did the mileage reporting methods collect and communicate information (fee, mileage, cumulative trip mileage/fee, or cumulative period mileage/fee) to the driver in real time? What were pilot participants’ perceptions regarding transparency and ease of compliance?
Where were the findings regarding TETC’s transparency?	Can drivers understand where and when fees were accrued after driving has occurred? Did the participants know before a trip starts about how much the fee rate and the total fee for trip? Can drivers easily understand and access their cumulative fee?

¹⁵ DHM Research, *I-95 MBUF: Focus Group and Participant Surveys-Summary* (2019).

Compliance Mechanisms

How Did the System Enforce Compliance?

Because pilot participants were volunteers, enforcement of participant compliance was not a focus. Prior to the pilot, TETC developed the following list of potential approaches to combating non-compliance and evasion:¹⁶

- Plug-in devices that automatically report whenever the device has been removed from the OBD-II port for some specified period of time
- Devices with anti-tampering construction
- In-vehicle systems that notify the account manager whenever the vehicle's onboard systems and electronics are tampered with
- Built-in data encryption to prevent data manipulation during transmission (also a privacy and security measure)
- Network firewalls, encryption, and anti-hacking systems for databases containing mileage and payment information (as well as personally identifiable information)
- Mileage true-up, which includes a verified odometer reading at key times such as sales, registration, or salvaged

TETC's *Administration and Compliance Issues Technical Memorandum* explored potential enforcement mechanisms and outlined possible approaches to enforcing compliance. This included prohibiting vehicle registration renewal, suspended driver license, late fees, and potential for civil and criminal penalties for fraudulent behavior.¹⁷ The report recognized the need for all individuals to pay their fair share to support the transportation system, but it also recognized that a system that tolerates a high number of people being able to evade the fee or participants who can cheat the system will likely not be supported.

Ease of Compliance

Because the only two mileage reporting options were highly automated, the ease of compliance from a user's standpoint was straightforward. Once the device was installed into the OBD-II port and the online account was activated, the level of effort required from participants was minimal. Accounts were accessed through an online portal, and monthly statements were provided to participants. Because the pilot did not use actual funds, payments were not required by participants.

Communication of Information to Driver

Did the Mileage Reporting Methods Collect and Communicate Information (Fee, Mileage, Cumulative Trip Mileage/Fee, or Cumulative Period Mileage/Fee) to the Driver in Real Time?

Participants had an online account that detailed the trips and fees assessed. The fees were variable across State lines and based upon the average fuel efficiency of the vehicle fleet (22

¹⁶ I-95 Corridor Coalition, *Mileage-Based User Fee Study: Administration and Compliance Issues Technical Memorandum* (2019), 12.

¹⁷ I-95 Corridor Coalition, *Administration and Compliance Issues Tech Memo* (2019), 12.

MPG) by the estimated motor fuel tax per-mile of the State where travel occurred. Because drivers may not understand the differences in existing motor fuel taxes among States, they may not understand a change in per-mile fee when crossing State lines. After driving occurred, participants were able to see a breakdown of fees and how the fees had been generated through driving.

What Was the Perception of the System’s Transparency among Pilot Participants?

According to the final report,¹⁸ focus group participants thought the monthly statements clearly communicated the fees accrued with an MBUF. They were satisfied with the statement’s ability to differentiate between what drivers would pay with an MBUF and a fuel tax.

Did Participants Know before a Trip Started about How Much the Fee Rate and the Total Fee for Trip?

The per-mile fee for each State was available to participants. With a single per-mile fee, in-State trips were straightforward to calculate: (miles driven) × (per-mile fee) – (fuel tax credit). The calculation became longer for interstate travel, where the miles driven in each State was calculated with a different per-mile fee and fuel tax credit.

It is helpful to understand the cost differences related to out-of-State driving. In TETC’s pilot, only 13-percent of the miles recorded were driven out of State. This implied that, on average, a small proportion of a participant’s monthly mileage would be driven out of State and subject to a different per-mile rate. Participants could see a higher rate for interstate travel if trips were to take place in higher-rate States, or participants could see a lower rate for interstate travel if trips were to take place in lower-rate States.

Can Drivers Understand Where and When Fees Were Accrued after Driving Had Occurred?

Participants had access to a trip log, and those with the GPS-enabled OBD-II device had a breakdown of trip by location. In both cases, the per-trip fees and accumulated fees were available for viewing after driving had occurred.

Key Findings on Ease of Compliance and Transparency

The highly automated MRDs and the ability for participants to access accounts and trip logs were both useful in supporting compliance and transparency. The complications of frequent interstate travel on the eastern seaboard made tracking, user auditing, and transparency complex. For users of GPS-enabled OBD-II devices, interstate travel data were available to calculate the cost of travel across multiple States with different per-mile fees. However, the process to audit the calculations was complex for users who frequently crossed State lines. Account statements and trip logs were made available to participants to show the fees were determined based on mileage driven within each State. For non-GPS OBD-II device users, only an estimate of out-of-State miles driven was used to calculate the fee. All travel was charged under a flat, blended rate regardless of where actual travel occurred. As such there was less effort involved in auditing the data for this MRM.

¹⁸ TETC, *Mileage-Based User Fee Exploration 2019 Passenger Vehicle Pilot* (2021), 18.

EQUITY ANALYSIS

This section examines equity-related findings regarding MBUF and the opinions and understating of populations, such as low-income and minority residents. Table 15 presents the evaluation questions and TETC-specific questions regarding equity.

Table 15. Evaluation and site-specific questions used to analyze road usage charge program equity.

Evaluation Question	Site-Specific Questions and Metrics
Was there analysis conducted regarding equity considerations of the proposed mileage-based user fee (MBUF) program?	What types of analyses were conducted to assess equity considerations?
What were the findings with respect to equity analysis?	Do the users pay a fair share based on road usage? How do user costs impact people in different income brackets and of different background (ethnicities, gender, English proficiency, TETC)?
What were the opinions and understanding held by members of populations based on income, race, ethnicity, gender, or English language proficiency?	What opinions did minority residents hold on specific matters related to the MBUF concept? What opinions did minority residents hold on specific matters listed above about the version of the MBUF that was piloted?

The findings reported in this section are sourced primarily from three reports.^{19,20,21}

Was There Analysis Conducted Regarding Equity Considerations of the Proposed Mileage-Based User Fee Program?

Prior to the pilot, a statewide survey included questions related to the perceived equity of an MBUF program. The pilot used two methods to assess equity considerations:

- Pilot participants were asked through surveys and focus groups whether or not they considered an MBUF to be equitable.
- The *Equity and Fairness Considerations in a Mileage-Based User Fee System Technical Memorandum* was prepared using a review of other published materials on the equity of MBUFs. The memorandum summarized key equity related findings from RUC/MBUF pilots nationwide. The memorandum acknowledged that findings from other States or regions may or may not be applicable to the eastern seaboard.

¹⁹ TETC, *Mileage-Based User Fee Exploration: 2019 Passenger Vehicle Pilot* (March 1, 2020).

²⁰ DHM Research, *I-95 MBUF: Focus Group and Participant Surveys-Summary* (2019).

²¹ I-95 Corridor Coalition, *Mileage-Based User Fee Study. Equity and Fairness Considerations in a Mileage-Based User Fee System Technical Memorandum* (2019).

Notably, equity was defined in Phase 2 as fairness with respect to two dimensions: people living in urban versus rural areas and people driving electric and fuel efficient vehicles. This was based on the findings from the Statewide survey conducted in Pennsylvania and Delaware prior to the start of the pilot. Representation in the pilot or opinions of other population categories (such as by income, race, ethnicity or English proficiency) was not a focus of the Phase 2 pilot.

What Were the Findings with Respect to Equity Considerations?

Survey and focus groups captured participants' concerns regarding MBUF impacts on specific groups. TETC addressed equity in participant focus groups as fairness of the MBUF program overall and towards specific user groups. In these public interactions the concept of pay for what you use appealed to participants' sense of fairness, as well as the principle that the source of transportation funding should be sustainable in the long term. Although it took some time for focus group participants to identify the central transportation funding dilemma tied to growing fuel economy of vehicles, once they understood the issue, sustainable funding became a high priority. This section discusses the equity topic areas that were explored in surveys and focus groups before, during, and after the pilot and in the technical memorandum on equity.

Topic: Is a Mileage-Based User Fee More or Less Fair Than a Gas Tax?

- General public survey: About half of respondents (52-percent) thought an MBUF would be "fair"—36-percent thought it would be as fair as the gas tax, and 16-percent thought it would be fairer than the gas tax. A smaller proportion of respondents, though still more than one-third (38-percent), thought an MBUF would be less fair than a gas tax.
- Participant engagement: Most focus group participants considered the above argument a good reason to support MBUFs.

The following considerations seemed to drive focus group participants' opinion that an MBUF was fairer than the gas tax:

- A desire for all drivers to contribute their fair share to road funding
- A concern about declining transportation funding and the resulting negative effects on quality of life, public safety, and the health of the economy
- A desire for out-of-State drivers to pay their fair share to maintain in-State roads—particularly Delaware focus group participants who were concerned about pass-through traffic

The following considerations seemed to drive focus group participants' opinions that an MBUF was less fair than the gas tax:

- Concern about financial penalties for drivers of electric and hybrid vehicles; some focus group participants suggested a slightly lower mileage rate for fuel-efficient vehicles
- Concern toward rural drivers who were assumed to drive longer distances for everyday activities

Topic: Is a Mileage-Based User Fee Fair to Drivers of Fuel-Efficient Vehicles?

Some focus group participants considered MBUF unfair to buyers of fuel-efficient vehicles as well as rural residents or those who drive long distances. According to the focus group and participant surveys summary:

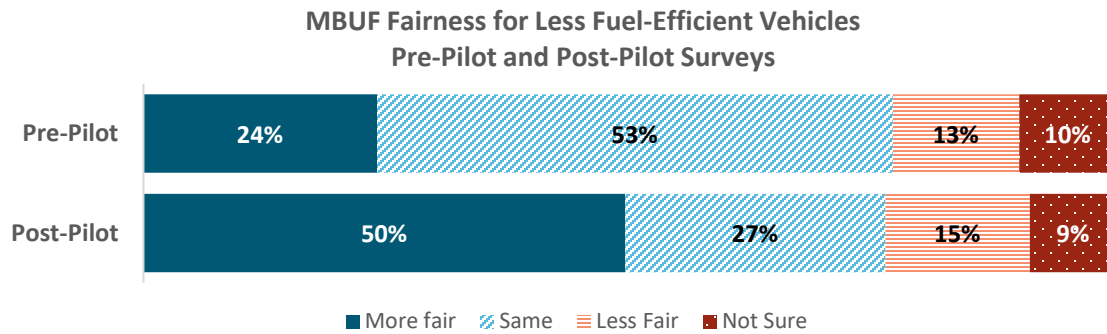
...This last position softened for two reasons: focus group participants driving long distances found little difference between what they would pay in fuel taxes as opposed to mileage fees; and over the course of the discussions they were able to unpack the overly simplistic assumption that a “mileage” fee would be more costly to drivers than a fuel-tax for those who drive more “miles.”²²

The pilot surveys also found that the phrase “pay for what you use” appealed to a sense of fairness among focus group participants, and as such, served as the strongest argument in favor of MBUF. TETC found that the phrase “pay for what you use” had the advantage of being memorable and easily understandable.

Key equity related findings under this topic area included:

- Hybrid and electric vehicle owners among focus group participants understood that while their fee would increase, they would still continue to see lower fuel costs in an MBUF model. TETC conveyed to focus group participants that even with the application of MBUF to electric vehicles, the owners still pay less in fuel plus MBUF costs compared to vehicles with internal combustion engines. However, participants wanted to ensure that policymakers would somehow continue to incentivize fuel-efficient vehicles. These participants were concerned that drivers of fuel-efficient vehicles “would suddenly and unfairly be punished for having made an investment in such vehicles.” This could, in turn, lead to negative climate and environmental impacts. A proposal for consideration of a variable mileage-based rate emerged, which would reward fuel-efficient vehicles with a lower rate.
- The pilot did not have a significant impact on the perception of MBUF as fair. The post-pilot survey showed only a 7-percentage-point increase in the number of participants who believed MBUF was fairer than—or about the same as—a gas tax, when compared to the pre-pilot survey. However, the pilot did affect how pilot participants viewed the impact of an MBUF on less fuel-efficient vehicles (see figure 6). TETC posited two explanations for this shift in attitudes:
 - Visibility into the impact on personal finances provided by the invoices. Focus group participants who drove less fuel-efficient vehicles were able to see that the estimated MBUF payment on their invoice would not significantly increase their net costs.
 - Increased awareness of inequity of the gas tax due to pilot participation. Participating in the pilot likely contributed to the increased appreciation for the central challenge of inequity in transportation funding (i.e., those with fuel-efficient vehicles are bearing a disproportionately smaller share of the burden of road improvements).

²² DHM Research, *Focus Group and Participant Surveys* (2019), 3.



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Figure 6. Chart. Mileage-based user fee fairness for less fuel-efficient vehicles in pre- and post-pilot surveys.

Topic: Is a Mileage-Based User Fee Fair to Rural Residents?

The baseline survey conducted with the general public in February 2019 found that the majority of participants in the two States considered MBUF unfair to rural residents who drive longer distances. However, at the same time, a majority of respondents also said that each driver should pay their fair share based on how much they use the roads rather than the fuel efficiency of their vehicle. This finding may point to a misunderstanding of MBUF, which can be potentially corrected through public education campaigns. These campaigns could specifically convey that MBUF is likely to have a net-zero impact on out-of-pocket costs for most drivers since a majority of vehicles currently on the road are not electric or hybrid vehicles.

The initial assumption of focus group participants was that rural residents drive farther than other people. However, participants were able to quickly understand that an MBUF would make no financial difference to rural residents who drive long distances in low- or average-fuel-economy vehicles. The technical memorandum also acknowledged competing concerns—real and perceived—if the identified equity concerns were to be addressed using variable rate structures for different demographics or vehicle types:

For example, if these western urban/rural results are also applicable to the eastern seaboard (i.e., rural drivers will likely pay less – either in absolute terms or relative to their urban counterparts), there shouldn't be any need to develop and implement a separate rate structure for urban and rural areas or households. However, a variable rate structure based on vehicle efficiency (as shown in previous figure 4), with the lowest efficiency vehicles being charged the highest per-mile rate, rural drivers would be negatively impacted as rural drivers typically get the fewest MPG. There is also the income variable to consider, for example, higher income drivers can afford to purchase more expensive vehicles (such as highly fuel-efficient vehicles) and can therefore afford to pay more in MBUF relative to the near zero cost of the gas tax.²³

²³ I-95 Corridor Coalition, *Mileage-Based User Fee Study: Equity and Fairness Considerations in a Mileage-Based User Fee System Technical Memorandum* (2019).

Topic: Do Different Rate Structures Have Different Equity Impacts?

TETC evaluated this topic through a review of literature. This topic was not explored through surveys and focus groups. Table 16 summarizes TETC’s qualitative analysis of potential impacts for different approaches for promoting equity in an MBUF program.

Table 16. Comparison of equity impacts from different mileage-based user fee (MBUF) rate structures.

Per-Mile Rate Approach	MBUF Costs Relative to Gas Tax			Comments/Potential Issues
	Higher	Little Change	Lower	
Single rate (revenue neutral)	Highly fuel-efficient vehicles (BEV); typically urban drivers	Vehicles that get average miles per gallon (MPG) (+/-)	Low-efficiency vehicles (gas guzzlers); typically rural drivers	Concern that BEVs pay more while high-polluting vehicles pay less than current.
Variable rate based on fuel efficiency (higher MPG equals lower MBUF rate)	BEVs; but not as high as single rate approach	Low-efficiency vehicles (gas guzzlers); vehicles that get average MPG (+/-)	None	MBUF rates are set as revenue neutral for low-to-average fuel-efficient vehicles. MBUF for BEVs will be the lowest, reflecting that these vehicles help the environment (if not charged by a coal-based electrical grid).
Variable rate based on roadway type and location (urban/rural)	Urban drivers		Rural drivers	Requires global positioning system (GPS) in vehicles to differentiate mileage by route/cordon and time-of-day. Mandating GPS will likely cause significant privacy concerns.
All of the above – concerns with income equity			Provide payment assistance to low-income households	Another possibility is to provide a lower MBUF rate for low-income drivers. Adds complexity to MBUF administration.

Source: Eastern Transportation Coalition, 2019.

Topic: Are There Other Dimensions of Equity in a Mileage-Based User Fee Program?

The technical memorandum defined relative impact on transportation finances between individual States as an equity issue. Based on TETC's MBUF rate model, some States would be net revenue gainers and others net revenue losers. The revenue scenarios depend upon how much gas is purchased in a State by out-of-State drivers and how much out-of-State mileage occurs.

What Were the Opinions and Understandings of Populations Based on Income, Race, Ethnicity, Gender, or English Language Proficiency?

There were no reported analyses that looked specifically at the opinions and understanding held by members of populations based on income, race, ethnicity, gender, or English language proficiency because it was not within the scope of TETC's Phase 2 exploration, although the research was designed to permit some such analysis. The 2019 survey of the general population used a mix of sampling quotas and weighting the final data set to make it feasible to assess opinions by subgroups such as age and gender.²⁴

Key Findings on Equity and Fairness

The participants' perception of MBUF's equity slightly increased during the pilot. However, focus groups uncovered a need for wider public education about a user-fee approach and its potential impact on the majority of residents—relative to their current tax burden and in relation to other interest groups.

A qualitative analysis of equity considerations presented multiple inter-related impacts that may need to be addressed if a variable rate structure or directed payment assistance program were to be investigated as part of the MBUF program.

AUDIT ANALYSIS

This section examines the findings regarding MBUF and the ability to audit the proposed system. Table 17 presents the key evaluation and site-specific questions on this topic. Since the ability to audit the system was not a significant focus of this phase of the pilot, some evaluation questions were irrelevant to the current scope of work.

Table 17. Evaluation and site-specific questions used to analyze the ability to audit the mileage-based user fee (MBUF) program.

Evaluation Question	Site-Specific Questions and Metrics
What were the findings regarding the Eastern Transportation Coalition's MBUF system's ability to audit?	What data were collected to test the system's ability to audit? Did the mileage reporting methods produce data that could be used for auditing purpose? What methods were used to gather information about the system's ability to audit?

²⁴ TETC, *Mileage-Based User Fee Exploration: 2019 Passenger Vehicle Pilot* (March 1, 2020), 12.

Ability to Audit

It is unclear if specific audit practices were developed for the pilot. However, the account manager was required to submit monthly data reports that provided updates on the program's MBUF revenue, vehicle identification number summary, errors, events, and help desk reports. The *Administration and Compliance Issues Technical Memorandum*²⁵ outlines the need for the State to perform periodic audits of the account manager and their records, which would need to have defined rules and record keeping requirements. The report also mentions there may be a conflict with record keeping requirements and the need to limit the collection and retention of personal and private data.

Did the Mileage Reporting Methods Produce Data That Could Be Used for Auditing Purposes?

Data generated by the GPS-enabled OBD-II device would provide an account by vehicle of trips and mileage accumulation. Both GPS devices and non-GPS devices could provide reporting of any device malfunction or prolonged disconnection from the vehicle.

SYSTEM COSTS

The Phase 2 pilot included a 19-percent addition to the per-mile fee to cover the cost of collection. The 19-percent represented TETC's estimate of system administration and compliance costs. This amount was based on a financial analysis conducted during the Phase 1 passenger vehicle pilot. In the Phase 2 final report,²⁶ TETC noted that a 19-percent addition to the per-mile fee was appropriate for small pilots, but that a lower percentage would likely be sufficient for larger systems, such as those over 1 million vehicles, and this percentage will continue to fall over time as systems become more efficient to operate. The report also noted the potential difference in administrative costs among States, and that a flat percentage for system administrative costs may be too much or too little. This assumption is likely to be influenced by variables within each State, such as number of vehicles enrolled and their respective per-mile fee.

A key finding from the Phase 2 pilot was that MBUF generated more revenue than the estimated motor fuel tax paid by participants. For the Phase 2 pilot, participants averaged more than 1,200 miles per month, and paid almost \$7.50 more per vehicle through the MBUF than estimated through the gas tax. TETC determined this was due to two factors: the addition of the 19-percent administrative cost and greater fuel efficiency of the vehicles participating in the pilot.²⁷ Because the MBUF rates were determined using the national fleet average of 22 MPG, drivers of any vehicle with a higher efficiency would pay more per mile than they would with the motor fuel tax. In the case of the Phase 2 pilot, the average fuel efficiency of the vehicles enrolled was 25.3 MPG. Since the rate calculation model ascribed a lower fuel efficiency to vehicles than actual, it computed a higher per-mile rate at the revenue neutral rate.²⁸ This accounted in part to the higher monthly fee in comparison to the motor fuel tax.

²⁵ I-95 Corridor Coalition, *Administration and Compliance Issues Tech Memo* (2019), 14.

²⁶ TETC, *Mileage-Based User Fee Exploration 2019 Passenger Vehicle Pilot* (2021), 35.

²⁷ TETC, *Mileage-Based User Fee Exploration 2019 Passenger Vehicle Pilot* (2021), 9–10.

²⁸ TETC, *Mileage-Based User Fee Exploration 2019 Passenger Vehicle Pilot* (2021), 10.

CHAPTER 5. INDEPENDENT EVALUATION FINDINGS—TRUCK PILOT

This chapter presents the findings of the truck pilot conducted as part of TETC's Phase 2 funded efforts. The truck pilot was conducted separately from the passenger vehicle pilot. The two pilots are different in several aspects. For example, the truck pilot did not involve outreach or education with the general public. It did not have the same equity considerations as the passenger vehicle pilot since population categories of interest do not map to specific considerations around fairness in the case of commercial vehicle operators. As a result, the evaluation framework presented in chapter 3 was not used to report the findings of this pilot. This chapter reports four main aspects of the truck pilot:

- Technical approach and system design
- Rate structure and funds reconciliation across jurisdictions
- Ease of compliance and transparency
- Stakeholder engagement and feedback

TECHNICAL APPROACH AND SYSTEM DESIGN

TETC recognizes the key role of motor carriers in the U.S. economy, and that a nationwide MBUF would need to address commercial vehicles driving and equitably contributing toward the maintenance of the transportation system. One of TETC's goals under the STSFA program was to assess how a user fee would fit into the unique operating environment, viewpoints, and regulatory environment of the trucking industry. As such, TETC designed a truck pilot to achieve the following objectives:

- Understand the unique challenges, needs, and viewpoints of the motor carrier industry.
- Recognize and acknowledging through stakeholder outreach that not only are commercial vehicles heavy users of the transportation system, but they also pay a significant amount to help build and maintain the system.
- Understand the existing list of reporting requirements that commercial vehicles have to comply with, including IFTA, International Registration Plan (IRP), and electronic logging device rules (ELD).

In order to understand the pilot design, it is important to examine the current regulatory framework that governs the trucking industry.

Commercial Vehicle Regulations

In order to understand TETC's chosen technical approach for the truck pilot, it is important to examine the regulations and agreements involving commercial vehicles that require the collection of mileage and other driving-related information.

IFTA is a cooperative agreement between the 48 contiguous States and 10 Canadian provinces that border the United States. IFTA enables uniform administration of motor fuel taxation among member jurisdictions. A key intent of the agreement is to distribute State motor fuel taxes among States and provinces based upon where driving occurs. For example, if truck drivers purchase fuel and pay motor fuel taxes in their home State but travel through neighboring States, IFTA

allows those fuel taxes to be distributed among the neighboring States. The agreement consolidates and streamlines the process. It requires drivers and fleets to submit updates to their home jurisdictions that demonstrate the location and quantity of fuel purchases, and the location of miles driven within participating IFTA jurisdictions. The home jurisdictions then submit records to the IFTA clearinghouse, which reconciles funds among the jurisdictions involved.

The establishment of IFTA brought several advantages to participating interstate motor carriers, including a single fuel tax license authorizing their vehicles to travel in all member jurisdictions, plus a single tax return filed each quarter with the jurisdiction where they are licensed. These returns contain mileage and fuel use information for all member jurisdictions.

The IFTA agreement is overseen by the International Fuel Tax Association, and taxes and reports are managed by each of the home jurisdictions. IFTA reports are submitted by a carrier to the home jurisdiction quarterly, and data can be collected from driver reports or from electronic logging devices that are IFTA compliant.

IRP is an agreement among individual States, the District of Columbia, and Canadian provinces that recognizes the registration of commercial motor vehicles issued by other jurisdictions. Motor carriers register with and pay registration fees to one jurisdiction. The fee is based on the portion of distance traveled in each jurisdiction; these fees are then distributed to the relevant jurisdictions. Registered motor carriers receive apportioned plates and are able to travel through all IRP member jurisdictions. Commercial motor vehicles either alone or used in combination weighing more than 26,000 pounds, and traveling in two or more jurisdictions, are likely registered under IRP.²⁹ IRP allows the use of electronic logging devices to document vehicle by jurisdiction, so long as they are IRP compliant. IRP is a separate agreement than IFTA but has a similar profile of vehicles that the agreement is applied to. The agreement is organized and managed by the International Registration Plan Inc.

The ELD rule is mandated by section 32301(b) of the Moving Ahead for Progress in the 21st Century Act (MAP-21) [Pub. L. No. 112-141, 126 Stat. 405, 786, July 6, 2012, codified at 49 U.S.C. 31137(a)-(f) and implemented by 49 CFR part 395, subpart B and appendix A to subpart B]. The act requires commercial motor vehicles (CMVs) involved in interstate commerce and operated by drivers subject to the hours-of-service (HOS) requirements of 49 CFR part 395 to be equipped with an ELD that meets the requirements of 49 U.S.C. 31137. The electronic record of duty status (RODS) created by the ELD identifies the operator's on-duty driving, on-duty not-driving, sleeper berth, and off-duty periods. In some cases, drivers may use a manual recording device in lieu of an ELD.³⁰ Some drivers are exempt from the ELD rule, including those who operate under the short-haul exception; are not required to keep a RODS more than 8 days within any 30-day period; drivers of vehicles manufactured before model year 2000; drivers transporting agricultural commodities and farm supplies for agricultural purposes pursuant to 49 CFR 395.1(k); and drivers who conduct drive-away-tow-away operations.

²⁹ International Registration Plan, accessed August 23, 2021, <https://staging-irpinc.site-ym.com/page/MotorCarrierHomepage>.

³⁰ ELD vendors self-certify the compliance of their devices with the requirements of appendix A to subpart B and may also be used to satisfy requirements for IFTA and IRP.

The Federal Motor Carrier Safety Administration’s (FMCSA) primary mission is to prevent CMV-related fatalities and injuries. Compliance with the HOS regulations in 49 CFR part 395 are an essential part of that mission.³¹ The HOS regulations limit maximum driving time, minimum break time, and minimum off-duty time. The regulations provide exceptions for short-haul drivers and certain other operations. The information recorded by ELDs is available to inspectors at roadside.

Not all electronic devices used in the trucking industry are the same. The ELD rule requires the installation of a device that meets the requirements of appendix A to subpart B of part 395. These devices may not satisfy IFTA and IRP requirements, as the data, accuracy of the data, and the reporting requirements of the regulations are distinct. An electronic device that satisfies only the FMCSA HOS requirements will be referred to as an HOS-compliant device.

Some devices available on the market are intended to satisfy IFTA and IRP requirements but may not be suitable for FMCSA and HOS requirements. Other devices are available that combine functionality to satisfy the FMCSA HOS requirements and also the IFTA and IRP requirements. The electronic logging device used in TETC’s Phase 2 truck pilot satisfies both FMCSA HOS and IFTA/IRP requirements. Devices that satisfy both FMCSA HOS and IFTA/IRP will be referred to as IFTA/IRP-compliant devices.

Overall Pilot Design

The truck pilot lasted 6 months from October 1, 2018, to March 31, 2019, with more than 50 trucks from four freight companies participating and traveling more than 1,430,000 miles across 27 States. A single account manager installed an in-vehicle device into each truck, which was used to track mileage and mileage location, as well as generate and report required data for the existing truck regulations.

Evaluation of System Design and Technical Accuracy

Table 18 presents the evaluation questions related to system design and technical accuracy.

Table 18. Evaluation questions regarding technical approach.

Evaluation Question
What mileage reporting methods (MRMs) were provided in the pilot?
What were the findings regarding technical accuracy of the MRMs provided to pilot participants?
How was the system configured? Does this configuration allow the system to adapt?

What Mileage Reporting Methods Were Provided in the Pilot?

A key aspect of the truck pilot was to test the viability of leveraging the systems already used by the trucking industry to record mileage, location, and trip times to satisfy requirements related to

³¹ FMCSA. “Hours of Service.” (website). <https://www.fmcsa.dot.gov/regulations/hours-of-service>, accessed January 25, 2022.

FMCSA, HOS, IFTA, and IRP.³² The systems commonly used to meet some of the requirements of these regulations already collect some of the data that would be needed to calculate an MBUF.

Electronic logging devices are required to be installed in interstate carriers to meet the ELD rule and satisfy HOS requirements mandated by FMCSA. TETC explored the potential to use these devices to support an MBUF. A key finding in the truck pilot is that electronic logging devices that satisfy only HOS requirements and are not IFTA compliant are inappropriate for an MBUF. They are not required to collect data continuously or with acceptable accuracy.³³ The device will collect the following information at 60-minute intervals:

- Date
- Time
- Vehicle geographic location information (longitude and latitude)
- Engine hours
- Vehicle miles
- Driver or authenticated user identification data
- Vehicle identification number
- Motor carrier identification data (USDOT number)

The minimum requirements of these devices do not support continuous collection and accuracy of location and mileage information. These devices use a 1-mile radius to identify location when on-duty, but a 10-mile radius for off-duty, which is not accurate enough for use in an MBUF. In addition, these devices are self-certified, implying that vendors themselves test the system requirements, leaving the potential for error if used in an MBUF system. TETC concluded that electronic logging devices used to satisfy only the ELD rule (i.e., HOS-compliance devices) are inappropriate for financial transactions where location accuracy is needed because their intent is to ensure compliance with HOS requirements, not an MBUF.³⁴

IFTA/ IRP-compliance devices. Truck operators and fleet companies are required to submit records at specified intervals to satisfy both HOS and IFTA/IRP requirements. The data collected to satisfy IFTA and IRP requirements are similar to the data needed to assess an MBUF. However, neither IFTA nor IRP require the use of, or certify, in-vehicle technology. They also allow carriers to manually report mileage and fuel use. HOS compliance, on the other hand, requires an electronic logging device that is certified through FMCSA.³⁵ A typical in-vehicle device installed in trucks to satisfy IFTA or IRP requirements uses a combination of internal and external sensors to measure vehicle driving values. These devices typically record:³⁶

- Location of each system reading (may be one reading every 15 minutes or less)
- Distance between readings

³² TETC, *Mileage-Based User Fee Study 2018-2019 Multi-State Truck Pilot Final Report* (July 2020), 2-1.

³³ ETC, *Multi-State Truck Pilot Final Report*, 3-12.

³⁴ TETC, *Multi-State Truck Pilot Final Report*, 3-13.

³⁵ TETC, *Multi-State Truck Pilot Final Report*, 1-10.

³⁶ IFTA/IRP Industry Advisory Committee Members, *Electronic Logging Device (ELD) Helpful system information to assist you in choosing a system right for your requirements*, April 2017.

- Routes of travel by unit
- Beginning and ending reading from the odometer, hubodometer, engine control module, or similar device
- Distance by jurisdiction by unit



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Figure 7. Illustration. In-vehicle device installed in trucks as part of the Eastern Transportation Coalition Phase 2 truck pilot.

Some of these electronic logging devices can satisfy both IFTA and HOS requirements. The device used in TETC truck pilot met requirements of both these regulations (see figure 7).

What Were the Findings Regarding Technical Accuracy of the Mileage Reporting Methods Provided to Pilot Participants?

The International Fuel Tax Association does not certify devices but provides a set of requirements that devices must meet to be IFTA/IRP compliant. The device used in the truck pilot was IFTA/IRP compliant and is already being used for tax reconciliation purposes between States. The *Multi-State Truck Pilot Concept of Operations*³⁷ reported the system used in the pilot was certified by a third-party transportation research expert to meet the FMCSA's functional requirements and it was also audited and approved for use in Oregon and New Zealand. Accordingly, TETC did not conduct additional testing of the device prior to the truck pilot. However, TETC compared the current State diesel tax (including IFTA distributions between States) and MBUF calculations and they were found to be accurate. Notably, the system used in TETC's pilot is also currently used in the State of Oregon for the State's weight mileage tax assessment and has been audited and assessed for that program.³⁸

³⁷ TETC, *Multi-State Truck Pilot Final Report*, 2-1.

³⁸ Based on information from TETC in response to questions submitted as part of the October 1 touchbase.

How Was the System Configured? Does This Configuration Allow System Flexibility to Adapt?

Existing HOS and IFTA/IRP structures allow for use of private account managers to meet their requirements, but do not necessitate them. TETC used a third-party private account manager for management of the hardware, collection of data, and enrollment of the logistics firms. IFTA/IRP and ELD regulations require drivers to provide updates for miles driven per jurisdiction and HOS within the required time period. As such, a new system was not developed for the pilot.

Key Findings on System Design and Technical Accuracy

The technology used in the pilot was used to satisfy the requirements for an MBUF, as well as IFTA, IRP, and HOS requirements. However, TETC found that electronic logging devices made exclusively for HOS reporting do not have the location accuracy to support financial transactions and fee collection.

EASE OF COMPLIANCE AND TRANSPARENCY

Evaluation of Ease of Compliance and Transparency

Ease of compliance refers to how easily the system can be complied with or circumvented, and the ability of program managers or law enforcement to identify evasion. Transparency refers to user awareness of what they are being charged and the basis for the charge. Table 19 presents evaluation questions related to user compliance, transparency, and user awareness of cost in accordance with the questions outlined in.

Table 19. Evaluation questions related to mileage-based user fee compliance and the transparency of cost information.

Evaluation Question
How did the system enforce compliance? Were any attempts to circumvent the system observed?
What level of effort was required of users?
Did the mileage reporting methods collect and communicate information (fee, mileage, cumulative trip mileage/fee, or cumulative period mileage/fee) to the driver in real time?
Could drivers understand where and when fees were accrued after driving has occurred? Did the participants know before a trip starts about how much the fee rate and the total fee for trip? Could drivers easily understand and access their cumulative fee?

How Did the System Enforce Compliance?

An automated IFTA/IRP-compliant electronic logging device was installed in each truck enrolled in the pilot that consolidated the capture of data needed to satisfy requirements for HOS, IFTA, and IRP, and to test the potential use in an MBUF system. Data from each of the devices are transmitted via cellular connection to the account manager who processes the data and

prepares reports to satisfy regulatory requirements. The data generated by the device includes mileage driven by location, which was used to calculate the MBUF for each vehicle and fleet according to the rates established for each State based upon their diesel tax rate. Compliance mechanisms are already in place for the existing regulations that trucks must operate within, and the MBUF pilot assumed these compliance mechanisms to thus be built into the existing system.

Were Any Attempts Made to Circumvent the System Observed?

No attempts to circumvent the system were indicated. Participants were commercial fleet operators who volunteered to participate, were not paying any fees toward an MBUF, and were required to comply with data collection through the existing regulations applied to trucks.

What Level of Effort Was Required of Users?

The data needed to support an MBUF were automatically collected through the in-vehicle device, which also recorded and reported the data needed to satisfy the existing regulations applied to trucks. As such, no incremental effort was required of pilot participants.

Did the Mileage Reporting Methods Collect and Communicate Information (Fee, Mileage, Cumulative Trip Mileage/Fee, or Cumulative Period Mileage/Fee) to the Driver in Real Time?

The IFTA/IRP-compliant electronic logging device used in the pilot had a digital screen that allowed drivers to see the cumulative miles for each trip and where mileage was accrued, with data transmitted to the account manager and the fleet. This data was then used to calculate the estimated MBUF by fleet, which accounted for the different per-mile fees by State. The use of a digital screen in the in-vehicle device provides the ability to communicate to drivers, in real time, the cumulative miles driven within each State.

Could Drivers and Fleets Understand Where and When Fees Were Accrued after Driving Had Occurred?

The data generated by the in-vehicle devices provide the geographic location of miles driven, i.e., the system can provide a breakdown of miles by State and the fee associated with the travel. Mileage and location data are already collected as part of IFTA and IRP requirements, and an MBUF would be an application of a per-mile fee to the data already collected.

Did the Participants Know before a Trip Starts About How Much the Fee Rate and the Total Fee for Trip?

The rate tables were established to be revenue neutral in relation to the State diesel taxes and were based upon a 6 MPG average for trucks nationwide. A truck traveling interstate would need to know the per-mile rate applied to their vehicle (if rates were established for different vehicle types) and the per-mile rate established within each of the States traveled. Participants were made aware of the rate schedule for each of the States and had the ability to calculate what the anticipated mileage fee would be based on anticipated travel.

Could Drivers Easily Understand and Access Their Cumulative Fee?

For each participating fleet, the account manager generated statements that included the following information:³⁹

- Number of participating trucks
- Average MPG for the pilot vehicles
- Number of States traveled through during the pilot
- Fuel purchased during the pilot
- Location of fuel purchased
- Mileage driven by fleet within each State
- Estimated cost of fuel
- Federal fuel tax
- State fuel tax
- Hypothetical MBUF

³⁹ TETC, *Multi-State Truck Pilot Final Report*, 2-5.



I-95 Multi State Truck Pilot Statement October 2018 – March 2019



Carrier

Fleet information

# of trucks	Average MPG (Q4 2018)	# of states traveled
5	6.33	16

Summary for the Pilot

Billable Miles Driven During the Pilot*		273,945.2	
Gallons of Fuel Used During the Pilot**		44,590.88	
	Estimated costs you currently pay*	Estimated MBUF based on 6 MPG (national average)	Estimated MBUF based on 4.1 MPG (pilot average)
Estimated Fuel Costs	\$117,023.00	\$117,023.00	\$117,023.00
Federal Fuel Tax	\$10,880.17	\$10,880.17	\$10,880.17
State Fuel Tax	\$18,920.28	-	-
Mileage-Based User Fee****	-	\$19,635.99	\$28,118.51
Total Estimated Costs	\$146,823.46	\$147,539.16	\$156,021.68
Net Difference from current: Rebate / (Owed)		(\$715.70)	(\$9,198.22)

Please note that all charges reflected on this statement are simulated. No amount of monetary value will be exchanged

*Distance exemptions as per IFTA.

**Based on your Average MPG

*** Based on per State monthly prices exclusive of taxes, sourced from the US Energy Information Administration

**** (Billable miles driven per State) x (per mile rate per State)

Disclaimer: The I-95 Corridor Coalition members and EROAD want to promote a better understanding of why investing in transportation is important, and why the current fuel tax does not provide a long-term and equitable solution in this regard. The Coalition, representing transportation agencies along the entire Eastern Seaboard, and EROAD believes exploring the feasibility of a MBUF solution is important; for now, however, the Coalition and EROAD are neutral if MBUF is the ultimate solution.

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Figure 7. Table. Example mileage-based user fee statement provided to fleet participants.

The intent was to demonstrate a comparison between the current fuel tax system and a potential MBUF system.⁴⁰ Drivers and fleets were able to understand where mileage was accumulated and how fees were calculated from the data (see figure 8 and figure 9).

⁴⁰ TETC, *Multi-State Truck Pilot Final Report*, 2-5.



I-95 Multi State Truck Pilot Statement October 2018 – March 2019



State	Total distance (mi)	Billable distance (mi)*	Estimated State fuel tax you currently pay**		MBUF Rate 1 (National average 6.0 MPG)***		MBUF Rate 2 (Pilot average 4.1 MPG)***	
			\$ per gallon	Total \$	\$ per mile	Total \$	\$ per mile	Total \$
Connecticut	46,870.6	46,870.6	0.4390	3,249.06	0.0732	3,430.93	0.1071	5,018.58
Delaware	106.9	106.9	0.2200	3.71	0.0367	3.92	0.0537	5.74
District of Columbia	-	-	0.2400	-	0.0400	-	0.0573	-
Florida	-	-	0.3437	-	0.0573	-	0.0788	-
Georgia	-	-	0.3000	-	0.0500	-	0.0734	-
Maine	72,510.1	72,510.1	0.3120	3,572.29	0.0520	3,770.53	0.0761	5,517.84
Maryland	614.3	614.3	0.3455	33.51	0.0576	35.38	0.0879	54.01
Massachusetts	45,942.7	37,495.6	0.2400	1,741.09	0.0400	1,499.82	0.0585	2,194.86
New Hampshire	8,815.9	8,815.9	0.2220	309.04	0.0370	326.19	0.0581	512.29
New Jersey	24,848.3	24,848.3	0.4420	1,734.25	0.0737	1,831.32	0.1183	2,939.37
New York	24,580.1	24,580.1	0.3915	1,519.53	0.0653	1,605.08	0.0584	1,435.84
North Carolina	-	-	0.3510	-	0.0585	-	0.0889	-
Pennsylvania	57,486.5	57,486.5	0.7410	6,726.32	0.1235	7,099.58	0.1807	10,389.63
Rhode Island	584.2	584.2	0.3300	30.44	0.0550	32.13	0.0829	48.45
South Carolina	-	-	0.2000	-	0.0333	-	0.0506	-
Vermont	-	-	0.3100	-	0.0517	-	0.0780	-
Virginia	32.7	32.7	0.2020	1.04	0.0337	1.10	0.0578	1.89
TOTAL	282,392.3	273,945.2		18,920.28		19,635.99		28,118.51

*Distance exemptions as per IFTA.

**Based on your Average MPG

*** (Billable miles driven per State) x (per mile rate per State)

Disclaimer: The I-95 Corridor Coalition members and EROAD want to promote a better understanding of why investing in transportation is important, and why the current fuel tax does not provide a long-term and equitable solution in this regard. The Coalition, representing transportation agencies along the entire Eastern Seaboard, and EROAD believes exploring the feasibility of a MBUF solution is important; for now, however, the Coalition and EROAD are neutral if MBUF is the ultimate solution.

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Figure 8. Table. Example mileage-based user fee statement provided to fleet participants showing comparison of different rates.

Key Findings on Ease of Compliance and Transparency

TETC concluded that the use of a highly automated in-vehicle device used for an MBUF could also satisfy the existing regulatory requirements for trucks. This would streamline the collection and reporting requirements that trucks and fleets are required to follow. Using an interactive screen would allow the system to communicate information to the driver to facilitate an understanding of how fees are assessed and how mileage is accrued through different States.

RATE STRUCTURE AND FUNDS RECONCILIATION ACROSS JURISDICTIONS

Evaluation of the Rate Structure and Proposed Funding Reconciliation

Table 20 presents the evaluation questions related to the system's rate structure and proposal for reconciliation of funds.

Table 20. Evaluation questions regarding rate structure.

Evaluation Question
What were the basis and assumption of the rate structure for the pilot?
What are the financial impacts of mileage-based user fees on trucks and truck operators?
How were funds proposed to be reconciled across jurisdictions?

What Were the Bases and Assumptions of the Rate Structure Used for the Pilot?

TETC intended the rate structure of the pilot to be revenue neutral. This implied that a truck with fuel efficiency matching the national average of 6 MPG would pay the same amount in an MBUF as it would in State diesel fuel tax. Because diesel fuel tax rates differ by State, TETC developed a per-mile rate structure based upon each State's diesel fuel tax and assuming a 6 MPG average (see table 21). The respective States were not involved in setting the per-mile rates used in the pilot. No actual funds were charged to the participants, and no funds were transferred between the account manager or between States.

Table 21. Mileage-based user fee rates by State.

State	Per-Mile Rate (Cent per Mile)	Diesel Excise Tax (Cent per Gallon)
Connecticut	7.32	43.09
Delaware	3.67	22.00
District of Columbia	4.00	23.50
Florida	5.73	34.97
Georgia	5.00	40.07
Maine	5.20	31.20
Maryland	5.76	36.05
Massachusetts	4.00	26.54
New Hampshire	3.70	23.83
New Jersey	7.37	48.50
New York	6.53	44.61
North Carolina	5.85	36.45
Pennsylvania	12.35	75.20
Rhode Island	5.50	34.00
South Carolina	3.33	20.75
Vermont	5.17	32.00
Virginia	3.37	24.71

Source: Eastern Transportation Coalition.

A summary of the truck pilot data is presented in table 22. The fleets enrolled in the pilot had an average fuel efficiency of 4.1 MPG, which is 31-percent lower than the national average of 6 MPG. A key finding of the pilot was that if an MBUF is to be revenue neutral when compared to the diesel fuel tax, a flat rate based off of the national fuel efficiency average would be inappropriate.

Table 22. Summary of truck pilot data.

Description	Carrier A	Carrier B	Carrier C	Carrier D	Total
Number of trucks in pilot	40	10	5	5	60
Average MPG	3.42	4.74	3.62	6.33	4.1
Number of States traveled	16	27	6	16	27
Miles driven	578,760	344,660	132,280	282,390	1,338,090
Billable miles	577,710	344,060	122,010	273,950	1,317,720
Gallons of fuel	169,230	72,730	36,540	44,590	323,090
Fuel costs	\$444,060	\$183,350	\$96,170	\$117,020	840,590
Fuel cost per mile	\$0.77	\$0.53	\$0.73	\$0.41	\$0.63
Federal fuel tax	\$41,290	\$17,750	\$8,920	\$10,880	\$78,840
State fuel tax	\$79,770	\$24,960	\$14,960	\$18,920	\$138,600
MBUF (@ 6 MPG)	\$45,440	\$19,690	\$8,620	\$19,640	\$93,390
Net MBUF (6 MPG)	(\$34,320)	(\$5,270)	(\$6,340)	\$720	(\$45,220)
MBUF (@ 4.1 MPG)	\$67,870	\$29,980	\$12,450	\$28,120	\$138,420
Net MBUF (4.1 MPG)	(\$11,890)	\$5,020	(\$2,510)	\$9,200	(\$190)

Note: MBUF = mileage-based user fee. MPG = mile per gallon.

Miles driven includes all miles driven in coalition States. This does not include the 91,910 miles driven outside the coalition States, for a total number of 1.43 million miles driven during the pilot. Billable miles include all miles driven in coalition States less any IFTA-exempted miles. Gallons of fuel used is estimated based on average fleet MPG. Estimated fuel costs are estimated based on the State monthly prices, exclusive of State and Federal taxes, sourced from the U.S. Energy Information Administration. Fuel taxes paid estimated based on gallons of fuel used and the Federal and State fuel taxes on diesel. MBUF is calculated as follows: billable miles per State × per-mile rate in each State. A net MBUF value in parenthesis represents a net credit to the carrier. Numbers are rounded to the nearest ten excluding Number of Trucks, Average MPG, Number of States Traveled, and Fuel Cost per mile.

What Are the Financial Impacts of a Mileage-Based User Fee on Trucks and Truck Operators?

TETC concluded that charging a flat rate for trucks would not necessarily be a revenue neutral rate in the switch from fuel taxes to an MBU. In a flat rate structure, some vehicles or carriers may end up paying more, and others may end up paying less than their current fuel tax. Notably, carriers with more fuel-efficient vehicles paid more than they had under the State fuel taxes, while carriers with less-efficient fleets paid less. The report explores the potential impact of an MBUF based on the national fleet average of 6 MPG using the fleets enrolled into the pilot as

examples. Transitioning from State fuel taxes to an MBUF would impact two different vehicles each driving 63,000 miles a year, the average mileage for trucks in the United States. The switch to an MBUF would reduce annual costs for less fuel-efficient vehicles and raise the costs for fuel-efficient vehicles. The report does this through a theoretical examination of the case of two trucks:

one with 3.5 MPG and one with 6.5 MPG. Assuming each truck drives 63,000 miles per year, the fuel inefficient truck would receive a “rebate” of \$3,200 and the fuel-efficient truck would be required to pay a “penalty” of \$400. At first, these differences may not seem large, but multiplied over a company’s fleet, the costs add up quickly. For example, one company (Carrier A) in the pilot had 40 vehicles with an average MPG of 3.42. If the per-mile MBUF rate was to be set using the national MPG average, this company would receive a rebate of over \$68,000 per year in State fuel taxes. The company with the most fuel-efficient fleet was Carrier D, and under the MBUF based on 6 MPG, they would be asked to pay a penalty of over \$1,400 for its five fuel-efficient trucks.⁴¹

In sum, moving from fuel taxes to an MBUF shifts some of the cost burden from the less efficient vehicles onto the fuel-efficient vehicles.

With a flat rate structure, the financial impact of an MBUF will not be the same across all fleets and will be subject to the particular characteristics of their fleet, where and how it operates, and multiplied by the size of the fleet. Some fleets may pay more, some may pay less under an MBUF when compared to the diesel motor fuel tax. The vehicle makeup of a fleet may be a result of decisions that consider the impact of an MBUF on a business. In addition, the cumulative impact that small changes in tax burden can have on a fleet should be recognized.

TETC pilot suggests that the variety of business models within the trucking industry indicates that an MBUF oriented toward trucks should not be a direct adaptation from a system designed for passenger vehicles, the majority of which are under an individual ownership model.

Trucks and fleet companies pay taxes and fees outside of the existing diesel motor fuel tax, such as the heavy-vehicle use tax; Federal excise tax (e.g., tire tax and retail truck tax); and a weight-mileage tax in Oregon, New York, Kentucky, and New Mexico. Additionally, trucks pay more at tolling locations based on characteristics such as number of axles and vehicle weight. A key finding of the truck pilot was a recognition that trucks already operate in a regulated environment, and that any effort to explore an MBUF should recognize that additional requirements and regulations may become burdensome. This includes regulations on driver training, work hours, emissions requirements, vehicle readiness, and tax reporting.⁴² A recommendation from the report was to use MBUF as a potential method to streamline the other regulatory requirements already applied to trucks and truck companies.

⁴¹ Fuel efficiency is a factor of the vehicle characteristics plus many other factors, including driving behavior, roadway congestion, vehicle age, terrain, payload, and in-town versus long-haul driving.

⁴² TETC, *Multi-State Truck Pilot Final Report*, 3-8.

How Were Funds Proposed to Be Reconciled across Jurisdictions?

A goal of the truck pilot was to better understand if MBUF can be integrated into the existing systems, and to use the existing systems to explore the impacts of an MBUF on trucks through real-life experience. For the truck pilot, no funds were reconciled across jurisdictions. However, the pilot did find that that IFTA and IRP may provide a roadmap for how a system can function to reconcile funds across jurisdictions with a framework that is already place and has existing credibility within the industry.⁴³

“The Coalition’s multi-state truck pilot clearly showed that one-rate for all trucks doesn’t work due to the vast differences in vehicle operations, types, ages, performance, and mileage travelled.”

~The Eastern Transportation Coalition (2020)

In engagement with the trucking industry and stakeholders, TETC found consensus that IFTA and IRP can provide a framework for national implementation of MBUF. The following areas were identified for further study to better understand the potential:⁴⁴

- Vehicle types – How would an MBUF be applied to vehicles that are not required to register with IFTA and IRP?
- Processing cycle – How do the frequency of reporting and payment requirements associated with IFTA and IRP impact a potential MBUF?
- Exemptions, surcharges, and consistency – How would commercial vehicles exempt from IFTA and IRP participate in an MBUF? An MBUF would need to apply to all vehicles, and many vehicles are currently exempt from IFTA and IRP.
- Fleet versus individual reporting – Would reporting for an MBUF be preferable on a fleet or individual basis? IFTA reporting is done at the fleet level, but individual reporting may be preferable for an MBUF due to compliance and audit activities
- Collection and distribution of funds – How should funds be collected and distributed in an MBUF system as opposed to the current IFTA and IRP approach? States are responsible for the collection of funds from motor carriers, and IFTA and IRP are needed to reconcile and redistribute those funds between States. An MBUF may change that current framework, where account managers collect funds and use a multi-State clearinghouse to reconcile funds between States.

Key Findings on Rate Structure and Funds Reconciliation

TETC found that IFTA and IRP provide a framework for developing an MBUF applied to commercial trucks that has the potential to work across State lines. However, the pilot concluded that more study is needed to understand how funds are reconciled, how rates are set, and how the system would extend beyond vehicles that are exempt from IFTA and IRP requirements. Additional effort is also needed to better understand the impacts of transitioning from a diesel motor fuel tax toward an MBUF that considers the complex facets that apply to the trucking industry.

⁴³ TETC, *Multi-State Truck Pilot Final Report*, 3-8.

⁴⁴ TETC, *Multi-State Truck Pilot Final Report*, 3-9.

TETC concluded that a flat rate applied to all trucks will have different impacts based on several factors. The trucking industry encompasses several business models, such as over-the-road trucking, long-distance haulers and drayage trucks, to name a few that have different load characteristics, per-mile costs, time sensitivities, and ownership models. Each of these business models may be affected in different ways by a shift from the diesel motor fuel tax toward an MBUF. An effort to make an MBUF revenue neutral will require a policy framework that recognizes those potential impacts.

STAKEHOLDER ENGAGEMENT AND FEEDBACK

TETC conducted engagement with trucking industry stakeholders to better understand their perspectives. Table 23 presents the evaluation and site-specific questions about this aspect of the pilot.

Table 23. Evaluation questions related to stakeholder engagement and feedback.

Evaluation Question
How did Eastern Transportation Coalition inform, educate, and build support among stakeholders?

How Did Eastern Transportation Coalition Inform, Educate, and Build Support among Stakeholders?

The truck pilot relied upon its technology partner to recruit four fleet companies into the program. The participant companies were required to be IFTA registrants, headquartered in one of TETC States, represent a range of fleet sizes, and cover a variety of carrier types across State lines.⁴⁵ Table 24 shows the breakdown of participants.

Table 24. Summary of mileage-based user fee truck pilot participants.

Carrier	Business Location	Number of Vehicles
A	New Jersey	40
B	North Carolina	10
C	Connecticut	5
D	Maine	5

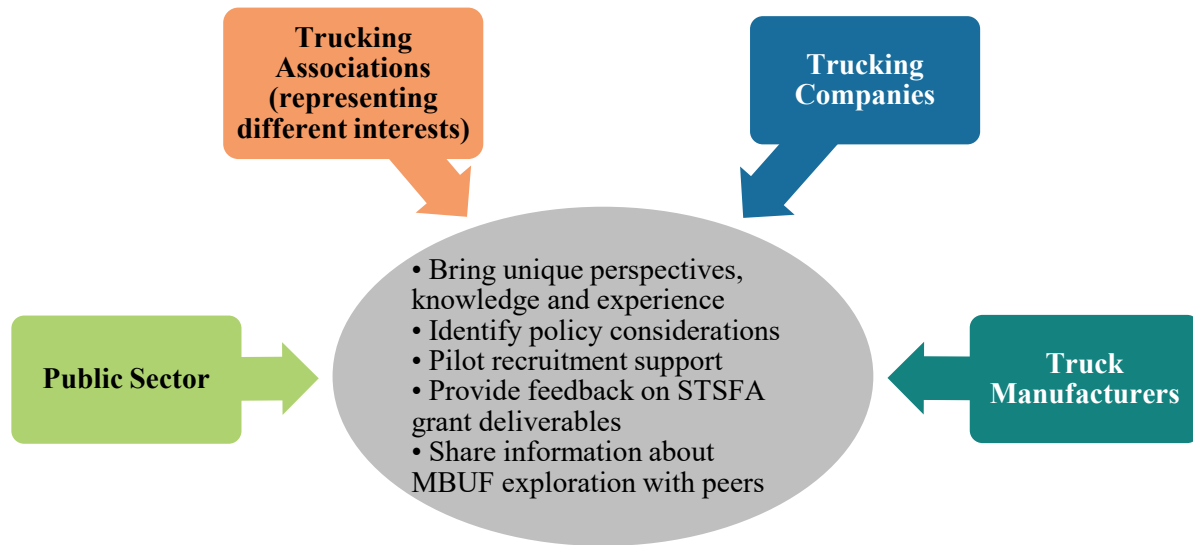
A key effort of the truck pilot was creating the motor carrier working group, which was intended to provide a variety of viewpoints related to the potential of an MBUF applied to trucks (see figure 10). The group was formed through industry contacts including the technology provider and TETC's own freight program director and freight academy.⁴⁶

Following the completion of the multi-State truck pilot, TETC made attempts to interview each of the four trucking firms that participated in the pilot using a questionnaire form. Only two

⁴⁵ TETC, *Multi-State Truck Pilot Final Report*, 2-4.

⁴⁶ TETC, *Multi-State Truck Pilot Final Report*, 3-2.

trucking firms were interested in being interviewed. The discussions were free flowing, with the interviewers going back to the questionnaire to ensure no key items were missed.



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Figure 10. Illustration. Mileage-based user fee motor carrier working group.

Key highlights from the meeting were provided in the final report and include:⁴⁷

- **Infrastructure funding.** The working group observed that MBUF is an attractive future option compared to tolling with some expressing concern that transportation revenue is not keeping up with infrastructure needs.
- **Implementation.** The following areas of interests, concerns and suggestions regarding and MBUF program’s implementations were recorded at the meeting:
 - Concern that MBUF should not add additional layers of complexity and that implementation acknowledge the fact that motor carriers manage fleets, i.e., MBUF reporting should be done at the fleet level to minimize unreasonable burden on motor carriers;
 - Concern that a national compliance and enforcement framework will be needed; that standards and certifications for system providers will be needed and; that MBUF will have potentially high administrative costs;
 - Concern that limiting MBUF to interstate routes would be contrary to the purpose of MBUF—to have users of the transportation system pay for what they use (regardless of where).
 - Interest in the development of MBUF data security, privacy, and ownership standards.
 - Observation that reporting frequency would need to be increased from quarterly to monthly to support a national MBUF approach.
 - Suggestion about dedicating MBUF revenue to transportation to help with motor carrier support.

⁴⁷ TETC, *Multi-State Truck Pilot Final Report*, 3-2.

- Interest in a review of record keeping requirements (e.g., how long and vehicle-specific data) would need to be revisited in light of a national MBUF system.
- **Rate setting.** The group expressed interest in rates being set in a transparent manner by elected officials. Suggestions for attributes to consider in rates setting included age of truck, vehicle class, weight, and fuel efficiency.
- **Pilot.** The group expressed interest in expanding the number of motor carriers participating in pilots. The group also expressed interest in additional educational material to explain MBUF and why the trucking industry should be engaged in this national discussion.
- **Congestion charge.** The group noted that further discussion about a congestion surcharge is warranted (e.g., will surcharge enable drivers to avoid congestion or simply add to the cost of freight movement?).
- **Regulatory framework.** The group noted that IFTA and IRP provide a framework template for a national implementation for MBUF.

The participants provided a general consensus that it would be possible to expand IFTA and IRP to include interstate carriers and vehicles less than 26,000 pounds, and that these existing systems provide a framework for a national implementation for MBUF. Participants did express concern that filing an MBUF report with each individual State would be a step backwards, and that MBUF could be a potential approach to simplifying and streamlining reporting and recordkeeping requirements. In addition, MBUF reporting would need to be done at the fleet level to prevent an unreasonable burden on individual operators.

Key Findings on Outreach, Engagement, and Perception

A key finding from the truck pilot was the importance of engaging the trucking industry and fully understanding their perspective related to an MBUF. The trucking industry is complex, highly regulated, and will experience an MBUF in a different way than passenger vehicles would. Making sure their voice is understood and the unique challenges of the industry are incorporated in implementation design of a commercial vehicle MBUF is an important component of future MBUF exploration.

CHAPTER 6. SUMMARY AND CONCLUSIONS

The independent evaluation assessed the impacts of STSFA-funded activities in a systematic manner across all sites. The following are key findings of the evaluation, using FAST Act⁴⁸ evaluation criteria, of TETC's Phase 2 passenger vehicle pilot:

- **Technical accuracy, precision, and repeatability of MRMs.** Providing a broad range of technology options to report mileage allows drivers to make trade-offs according to their needs, preferences, abilities, and sensitivities. The following are key findings regarding MRDs used in the Phase 2 pilot:
 - The GPS-enabled OBD-II device was accurate enough to identify vehicles within a tolling express lane with 90-percent accuracy compared to the RFID transponder. This suggests the technology could potentially support interoperability between MBUF and tolling.
 - The non-GPS OBD-II device will still be subject to the same level of accuracy as the vehicle's odometer, which is subject to a number of variables that can affect accuracy.
- **Public outreach and communication.** Given limited public knowledge about transportation funding topics, TETC used a multipronged approach including broad-based media strategies, social media campaigns, and specific stakeholder outreach by State agencies for pilot enrollment. Future pilots may benefit from public opinion surveying that oversamples respondents from populations of interest (e.g., by income or race) so their views can be assessed with some certainty. Similarly, future pilots may also benefit from a pilot participant recruitment plan designed to ensure inclusion of participants who represent these populations.
- **Public perception and acceptance of RUC.** The pilot led to a marginal increase in participant support for adopting MBUF as the primary transportation funding source. The pilot did not significantly change participants' attitudes toward fairness of MBUF overall. However, it decreased participants' uncertainty and slightly increased confidence that MBUF is fairer than fuel taxes. The surveys and focus groups confirmed that fairness and the concept of "pay for what you use" is the strongest argument in favor of an MBUF. The pilot helped increase participants' appreciation for certain aspects of an MBUF, such as a relatively lower tax burden for low fuel-efficient vehicles. The pilot successfully provided TETC with insights into participants' preferences, such as an MRD with location data collection capability, despite their privacy concerns. It also provided insight into other participant concerns such as fairness for all users and for specific categories of users (e.g., rural drivers, low-income drivers, drivers of fuel-efficient vehicles.)
- **Interoperability and reconciliation.** TETC recognizes the need for interoperability of a future MBUF system. The eastern seaboard includes several large urban centers, often spread across many State boundaries. For a fair application of an MBUF, interstate travel would need to be accounted for. Understanding how out-of-State mileage may be estimated and applied to calculate a rate is a key requirement for offering MRDs that do not collect location information from drivers. TETC's Phase 1 analysis indicated that

⁴⁸ Pub. L. No. 114–94.

estimates of out-of-State travel did not accurately represent actual miles driven by participants by State. For Phase 2, TETC devised a rate calculation mechanism to consider interstate travel based on census data about travel in the region. However, more analysis may be needed to understand and account for interstate travel for drivers who choose non-GPS-enabled MRDs. The potential to integrate MBUF technology into tolling could allow for a streamlined, consolidated approach to reporting and administering fees for both systems. The pilot suggests MBUF technology could potentially be used in tolling applications but may require additional study and piloting.

- **Privacy and data security.** The topic of data security was not the primary motivation among pilot participants. However, pilot participation helped alleviate some concerns about privacy and data security among participants.
- **Ease of user compliance and transparency.** The highly automated MRDs and the ability for participants to access accounts and trip logs were useful in supporting compliance and transparency. The complications of frequent interstate travel on the eastern seaboard make tracking, user auditing, and transparency complex. For users of GPS-enabled OBD-II devices, interstate travel data were available to calculate the cost of travel across multiple States with different per-mile fees. However, the process to audit the calculations in this case would be complex for participants who frequently cross State lines. Account statements and trip logs were available to participants after a trip had occurred to show how fees were determined based on mileage driven within each State. For non-GPS OBD-II devices, only an estimate of miles driven out of State was used to calculate the fee. All travel was charged under a flat, blended rate regardless of where actual travel had occurred. As such, there was less effort involved in auditing the data for this MRM.
- **Equity.** The perception of equity of an MBUF only slightly improved through pilot participation. However, participant focus groups uncovered a need for wider public education about a user-fee approach and its potential impact on the majority of residents—relative to their current tax burden and to other groups. A qualitative analysis of equity considerations presented multiple inter-related impacts that may need to be addressed if a variable rate structure or direct payment assistance programs were to be investigated as part of the MBUF program.

The scope of this phase of the pilot did not explore system cost, equity, congestion mitigation, the system's ability to audit, or data security and privacy considerations.

The following are key findings of the evaluation of TETC's Phase 2 truck pilot:

- **System design and technical accuracy.** The technology used in the pilot was used to satisfy the requirements for an MBUF, as well as IFTA, IRP, and HOS requirements. However, TETC found that electronic logging devices made exclusively for HOS reporting do not have the location accuracy to support financial transactions and fee collection.
- **Ease of compliance and transparency.** TETC concluded that the use of a highly automated in-vehicle device used for an MBUF could also satisfy the existing regulatory requirements for trucks. This would streamline the collection and reporting requirements that trucks and fleets are required to follow. Using an interactive screen would allow the

system to communicate information to the driver to facilitate an understanding of how fees are assessed and how mileage is accrued through different States.

- **Rate structure and funds reconciliation.** TETC found that IFTA and IRP provide a framework for developing an MBUF applied to commercial trucks that has the potential to work across State lines. However, the pilot concluded that more study is needed to understand how funds are reconciled, how rates are set, and how the system would extend beyond vehicles that fall under IFTA and IRP requirements. Additional effort is also needed to better understand the impacts of transitioning from a diesel motor fuel tax toward an MBUF that considers the complex facets that apply to the trucking industry. TETC concluded that a flat rate applied to all trucks will have different impacts based on several factors. The trucking industry encompasses several business models, such as over-the-road trucking, long-distance haulers, drayage trucks that have different load characteristics, per-mile costs, time sensitivities, and ownership models. Each of these business models may be affected in different ways by a shift from the diesel motor fuel tax toward an MBUF. An effort to make an MBUF revenue neutral will require a policy framework that recognizes the potential impacts.
- **Stakeholder engagement and feedback.** A key finding from the truck pilot was the importance of engaging the trucking industry and fully understanding their perspective related to an MBUF. The trucking industry is complex, highly regulated, and will experience an MBUF in a different way than passenger vehicles would. Making sure their voice is understood and the unique challenges of their industry are incorporated in implementation design of a commercial vehicle MBUF is an important component of future MBUF exploration.

IMPLICATIONS FOR NATIONAL IMPLEMENTATION

TETC is the first demonstration of an alternative transportation revenue mechanism along the east coast with participant travel across States incorporated into a non-GPS MRM. It is also the first pilot that has incorporated a significant component of commercial vehicles into its program. As a proof-of-concept, this phase of ETC's pilot demonstrates the potential for further MBUF exploration, the technical questions that can be addressed through continued research and pilot efforts, and some of the harder questions that are beyond the grasp of regional pilot.

U.S. Department of Transportation
Federal Highway Administration
Office of Operations
1200 New Jersey Avenue, SE
Washington, DC 20590

Office of Operations website
www.ops.fhwa.dot.gov

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